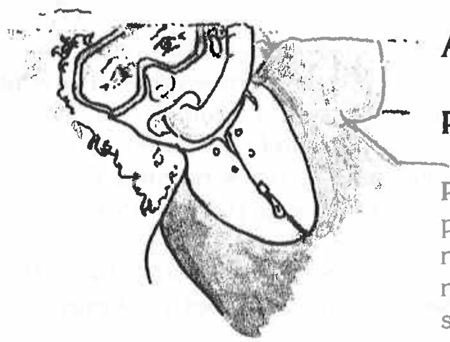
Dive To The Coral Reefs

(GPN # 61)



Author: Paul Erickson, Les Kaufman, and Elizabeth Tayntor

Publisher: Crown

Science Focused

Program Description: A coral reef is created by a colony of living coral polyps. As the reef grows, it becomes the center of a dynamic ocean community. For a closer look at this phenomenon, LeVar dons scuba equipment and takes us on a dive to the coral reefs off the Florida Keys where we see a variety of tropical fish and coral. We also learn about the ecology of coral reefs from a "reef doctor" who restores life to damaged reefs by transplanting living coral.

Guided Dive

Key Words: *simulate, experience, imagination*

Concept: *Imagination and literature can be powerful tools in simulating an experience.*

Introduce **Dive To The Coral Reefs** with a simulated dive experience by using **What's In The Deep? An Underwater Adventure For Children** by Alese and Morton Pechter (Acropolis Books, Ltd.). Invite students to use their imagination to create their own underwater experience as the book is read to them.

Animals And Plants

Key Words: *coral, reef, polyp, animal, cell, plant, symbiosis*

Concept: *Coral reefs are formed by animals and plants working together in symbiotic relationships.*

A coral reef is built by colonies of many individual coral polyps. Most polyps are less than an inch in diameter and, as they grow, they make a hard covering. A coral reef is composed of many hundreds of layers of these which are deposited on a base of rocks or sunken objects.

Corals are animals, but they have plant cells living inside them (the plants are a brown-colored algae called zooanthellae). It is not known for certain what the two living things do for each other, but we do know that many kinds of coral, and all reef-building corals in particular, require the presence of the algae in order to survive. Scientists think that the coral supplies nitrogen and carbon dioxide to the plant and that the plant supplies oxygen and food (carbohydrates) to the coral. The coral never ingests the plant cells, but lives on surplus food produced by the algae. This mutually beneficial relationship of two dissimilar organisms is called symbiosis.

Use the following dough recipe to explore the relationship of organisms and to create coral models for the next activity, ***Sea Scene.*** (The cinnamon grains represent the algae that live in the coral.) Photographs in the feature book **Dive To The Coral Reefs** by Elizabeth Tayntor, Paul Erickson and Les Kaufman can be a resource for designing coral models.

- 1 1/2 cup flour
- 1/2 cup salt
- 1/2 cup water
- 1/4 cup cooking oil
- 1 teaspoon cinnamon

Mix the flour, salt, water and cooking oil together to make the dough. Have students knead the cinnamon into the dough as you describe the relationship between the plants and the corals. Use toothpicks, plastic forks, pencils and other items to make textures on the corals.

Sea Scene

Key Words: *coral reef, community, model*

Concept: *Models can help us visualize environments.*

Create a model of a coral reef environment complete with the sea creatures that live in the area.

Materials: Shoeboxes, coral models from the ***Animals and Plants*** activity, blue paper, drawing paper, crayons, tape, glue, string, resource books about coral reefs.

Have students use resource books to research the sea life found in a coral reef community, and then choose the plant and animal life they want to represent in their model. In creating their model, students can begin by lining the box with blue paper (the color of the ocean) and determining the placement of the coral model created in ***Animals and Plants.***

Next, have them draw fish and other sea life using paper, crayons and glue, and attach these creations to the model (swimming creatures can be hung from the top of the box with string).

Students can make a small outline drawing of the model (to be hung or laid next to it) with the sea life labeled. This will help others identify the animal and plant life.

Hard As A Reef

Key Words: *polyps, calcium carbonate, chemical properties, acid, gas*

Concept: *Chemicals, such as the calcium carbonate which makes up most of a coral reef, have properties such as the ability to react with other chemicals.*

Coral polyps build reefs by laying down many layers of calcium carbonate. Calcium carbonate is a gray-white compound that makes up the shells of many underwater creatures. Shells from other creatures that drop onto the reef are encrusted by corals and become part of the reef. Although calcium carbonate is a solid, it is a soft rock that wears away easily. This makes reefs very fragile. Explore the chemical properties of calcium carbonate.

Materials: Three clear plastic cups, water, white vinegar, calcium carbonate (calcium supplement tablets*), pencil.

1. Pour water into 1 clear cup, vinegar into another and an equal mixture of water and vinegar into the third. The volumes of liquid in the 3 clear cups should be approximately the same. (To simulate seawater, add a small amount of salt to the water; this will not change the results.)

2. Make a table to record observations. Divide the paper into three columns and label a column for each liquid.

3. Drop a calcium carbonate tablet into the cup with water, and another into the cup with vinegar. Have students record their observations. (The calcium carbonate reacts with the acetic acid in the vinegar and gives off bubbles of carbon dioxide gas — indicating a chemical reaction; the water produces no visible change at first but the calcium carbonate will slowly dissolve.)

4. Have students use their observations to predict what will happen when they drop a piece of calcium carbonate into the water and vinegar mixture. Let them test this prediction, and record their observations.

5. To confirm that they understand the reactions of these liquids with calcium carbonate, have group members take turns closing their eyes while someone switches the cups around. Ask students to identify the liquid by observing the reactions occurring in each. Save the liquid for the next activity — ***Making Light Of It.***

Science Note: This reaction is very much like the reaction between baking soda and vinegar. Baking soda contains sodium bicarbonate. It is the carbonate ion in both the calcium carbonate and the sodium bicarbonate that reacts with the acetic acid in the vinegar. Any other acid would produce the same general reaction, although with differing rates. Stronger acids will cause a faster reaction.

***Calcium supplement tablets.** Read the label to find tablets that are primarily composed of oyster shell (oyster shell and coral are both made of calcium carbonate). These tablets are not dangerous, although, like any chemical, they should be treated with care and should not be swallowed by students.

Making Light Of It

Key Words: *light, photosynthesis, particles*

Concept: *Reef-building corals need light for photosynthesis.*

Because of the algae that lives in most corals, coral colonies only grow where there is enough light for these plants to make food (photosynthesis). When small particles from the ocean floor are stirred up by storms or motor boats, light needed for photosynthesis is blocked. The same can happen when buildings are being constructed near the shore and loose dirt and sand are washed into the water. All of these situations may harm the coral and can eventually kill it.

Materials: Water from the ***Hard As A Reef*** activity (or water with flour or talcum powder), magazine, tape, drinking straws, ruler, paper, pencils.

1. To demonstrate how particles in the water can block the light, let the water from ***Hard As A Reef*** settle so all the residue is on the bottom. (Water with particles can also be made using flour or talcum powder. Stir in the particles and then let the cup of water sit overnight to settle.)

2. Cut a word from a magazine. Take a piece of tape a little more than double the length of the word, placing the tape over both sides of the word to waterproof it. Then tape the word to the lower part of the straw so it will be face up when the straw is standing on end.

3. Lower the word gently into the water by guiding the word and straw along the inside wall of the container. Looking down into the cup, measure how far into the water the word can be read. This indicates how well light is penetrating the water.

4. Now stir the particles from the bottom. Again, measure how far into the water the word can be read. The floating particles will block some of the light so the word will be more difficult to read.

Getting To The Heat Of The Matter

Key Words: *latitude, globe, heat retention, water*

Concept: *The heat retaining property of water, combined with the amount of light received at certain latitudes, determines where conditions are right for reefs to form.*

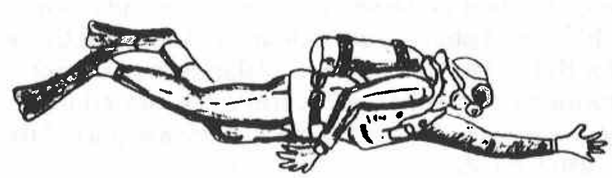
Because corals need warm water (77°-85° F or 25°-30° C) to thrive, coral reefs are only found in places close to the equator — usually within a band from 30° north latitude to 30° south latitude. Identify this area on a world map or globe and then use this activity to compare the heat retention of large and small volumes of water.

Materials: Plastic containers of different sizes, warm water, cool water, thermometers, paper, pencils.

1. To create the water temperature needed by corals, mix warm and cool water by adding amounts of each until the temperature is about 80° F (27° C). Have some groups use large containers and others use small ones so there are different volumes of water to compare.

2. After each group has a container of water at the ideal temperature, record the water temperature and set the water aside for 15 minutes. After 15 minutes, check the water temperature again and record it. Continue to check and record the water temperature at 15-minute intervals for several more times.

Students will find that the larger the volume of water, the slower the temperature will change. Oceans, because they are large bodies of water, have little variance in temperature. Many plant and animal ocean dwellers — including coral — depend on this temperature stability to live.



Ups And Downs

Key Words: *floating, sinking, buoyancy, swim bladder*

Concept: *Most fish can go up and down easily in water because they have neutral buoyancy, which for many is caused by the swim bladder.*

A variety of fish live around the coral reefs. While many things float and others sink, most fish don't do either. Fish can move up and down in the water, as well as from side to side, because of an organ called a swim bladder which makes them bouyant enough so they don't sink or float to the surface. This is referred to as neutral buoyancy. Because of their swim bladder, fish can go up and down easily with just the flick of a fin. Explore buoyancy with this model.

Materials: Flexible clear plastic bottle with lid (e.g. 16 oz. plastic soda pop bottle), seltzer water, water, grains of brown rice.

1. Fill a clear plastic bottle half full with seltzer water. Then add plain water until the bottle is about 3/4 full.

2. Drop in a few grains of brown rice and replace the lid. (Use brown rice because the seed coat is still intact and the gas bubbles will adhere to the seed coat.)

3. Gently squeeze the bottle. The pressure will build, making the bubbles in the water shrink. As the bubbles adhering to the rice shrink, the rice will sink. Students can focus on one grain of rice and try to push just enough on the bottle so the grain floats in the middle of the water, without moving up or down. At that point the rice has neutral buoyancy, just as a fish does.

How Islands Happen

Key Words: *islands, volcanic*

Concept: *Islands do not float, but are attached to the sea floor.*

Discuss with students that islands do not float, but are attached to the sea floor. Some islands — and virtually all atolls — are volcanic. (See the activities for **Hill of Fire** in this guide.) Islands that are not formed by volcanos and coral were formed in the same way as the continents — they are part of the earth's crust.

Atoll Tale

Key Words: *atoll, fringing reef, barrier reef, submerge, volcano*

Concept: *There are different kinds of coral reefs.*

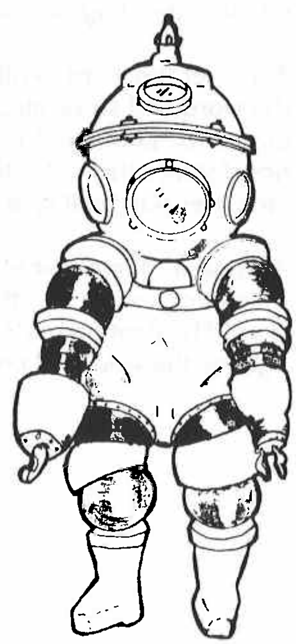
There are three basic kinds of reefs — fringing reefs, barrier reefs and atolls. Fringing reefs are built-out laterally from a shore. Barrier reefs are separated from land by a lagoon. Atolls are rings of coral that enclose a lagoon. In 1837, Charles Darwin theorized that atolls grew around submerged volcanoes as they slowly sank or subsided into the sea. Over a hundred years later Darwin was proved correct when a core sample was drilled from an atoll and volcanic rock was found beneath the coral. The ring of coral that makes up the atoll protects the area inside the reef.

Materials: Paper cup, baking pan, water, pencil shavings, sand or gravel (optional).

1. Cut or carefully tear the bottom 1/3 off of a paper cup, leaving an open cone. The torn edge should be fairly even.

2. Place the cup in a pan with the larger (non-torn) end down. To create a more realistic atoll model, add sand or gravel — just covering the bottom inside of the pan and paper cup. Add water so that the torn end of the cup is just below the surface of the water.

3. Sprinkle a few pencil shavings on the water in and around the model atoll. Use a finger to make waves around the model atoll and watch how the pencil shavings move. Notice how the reef shelters the lagoon.



Because the lagoon inside the atoll perimeter is protected, oftentimes different plant and animal species live inside the reef than live in the unprotected areas outside of it.

Duncan And Dolores

(GPN # 52)

Author: Barbara Samuels
Publisher: Simon & Schuster

Science Comes Alive
Science Connected

Program Description: LeVar learns about big cats when he visits Marine World Africa USA, and witnesses how humans can take on the look and movements of cats in a behind-the-scenes tour of the Broadway musical "CATS."

Binocular Vision

Key Words: *cats, field of vision, binocular vision*

Concept: *Cats and people have binocular vision.*

Cats, big and small, have a kind of vision called binocular vision. Animals with binocular vision have eyes that are close together in the front of their face and can judge distances very well. For instance, an animal with binocular vision can tell the distance to a mouse it is trying to catch for dinner. However because of the placement of their eyes, they cannot see what is behind them or beside them very well.

Some animals that do not have binocular vision, like mice, have eyes on the sides of their head. They cannot judge distances as well, but they have a different advantage. They can see what is in front of them, beside them, and almost behind them—like a cat jumping at them from behind a bush.

Materials: pencil, photograph or small picture, tape.

1. Show students the illustration of a cat's binocular vision that works well for judging distances and the contrasting vision of a mouse that has a wider range of vision. Tell students that in this activity they will learn if they have binocular vision.

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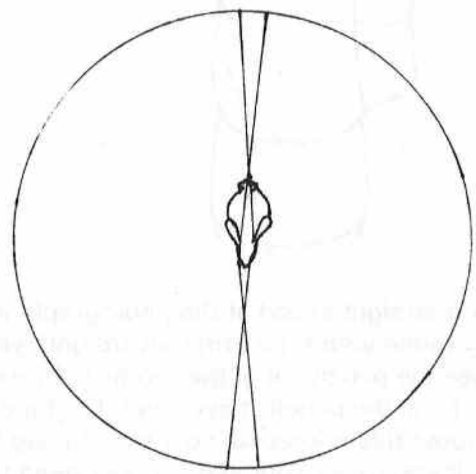
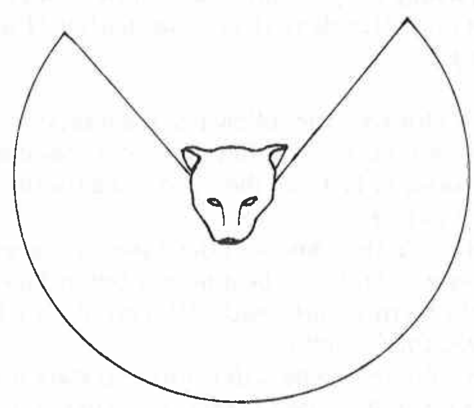


mouse



cat

2. Tape a photograph on a wall at eye-level. Stand directly in front of the photograph and about 3 feet away.

3. Hold a pencil vertically in your right hand. Move your right arm so the pencil is at eye level and as far behind your shoulder as you can hold it. You should not be able to see the pencil without turning your head to look at it.

4. Look straight ahead at the photograph and slowly move your right arm forward until you can first see the pencil out of the "corner of your eye." Try to keep the pencil at eye level. The hardest part about this is keeping your eyes facing forward. If you move your eyes or your head to look at the pencil, start over. Once you can see the pencil while still looking forward, hold the pencil still and then turn just your head to see where it is. It will likely be at or in front of your shoulder. This is the edge of your field of vision. Try the same thing using your left arm. Is your field of vision the same on both sides? (*It is usually about the same.*)

5. Ask students the following questions:

- Is their vision like that of a cat, binocular vision, or is it like the vision of a mouse? (*A cat's.*)
- How do they know? (*Because we have limited vision of what is beside and behind us without turning our heads. We can also judge distances well.*)
- Would people be safer drivers if they had eyes on the sides of their head like a mouse? (*People would have trouble judging distance, but they would have better side and rear vision.*)

Walking A Line

Key Words: *cats, balance, center of gravity*

Concept: *Cats use their tails to help them keep their balance as they move.*

As the tiger in this episode playfully chased his trainer, the tiger's tail swung from side to side. When tigers and other cats are running or jumping they use their long tails to help them balance. We don't have a tail but we often use our arms in much the same way.

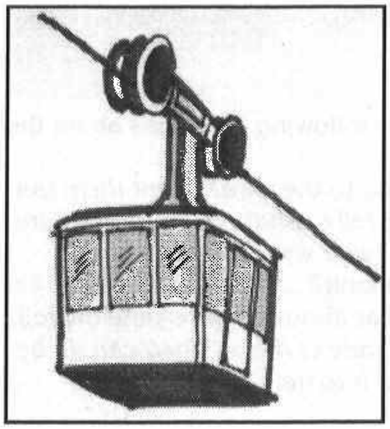
Materials: Yardstick, tape.

1. Tape a yardstick down on the floor.

2. Ask students to quickly walk along the yardstick trying not to fall off. Then ask the students to try again, but this time ask them to hold their arms and hands down and against the sides of their bodies. Students may find this very difficult. Ask the students why it was easier to walk along the stick using their arms and hands held out. Help them to understand that they use their hands and arms to balance.

3. Walk along the yardstick and demonstrate for the students how our arms help us to balance. Show them that if you start to fall to one side, you raise an arm, or even a leg, on the other side. This moves your center of gravity back over the yardstick and helps you to straighten back up.

4. Ask students how cats like tigers, lions, and cheetahs, keep their balance. Explain that when they are chasing an animal, they must run very fast and make quick turns, yet they do not have an arm to hold out to help them keep their balance. Students may guess that they use their tails or you may need to tell them. If possible show the clip in the show where the tigers at Tiger Island are playing with and chasing the trainer. Help the children to note how the tigers use their tails. When the tigers are walking their tails are usually down and relaxed but when they are running or jumping their tail are out moving from side to side, helping them to keep their balance.



Galimoto

(GPN # 74)

Author: Karen Lynn Williams
Illustrator: Catherine Stock
Publisher: Lothrop, Lee, & Shepard

Science Connected

Program Description: Something as common and uncomplicated as wire can be used to create complicated and interesting things. LeVar interviews a wire artist who makes sculptures from wire, a circus family who does high wire acts without a net, and he takes the longest tramway in the world—which, by coincidence, moves on a cable wire.

All Together Now

Key Words: experimentation, wire, combined strength, cable

Concept: Cable is made by twisting wire strands together which increases their strength.

In this episode, LeVar takes a ride on the world's longest cable tramway located in Albuquerque, New Mexico. The tramway is supported and pulled by cable wire. Even a thin wire can be quite strong, but the kind of wires used for this tramway have to be extremely strong. That's why they used cable wire made from several thick wires twisted together. See how twisting strands of thread together can increase their strength. (Thread is used in place of wire because it can take close to 100 lbs. to break even a thin wire.)

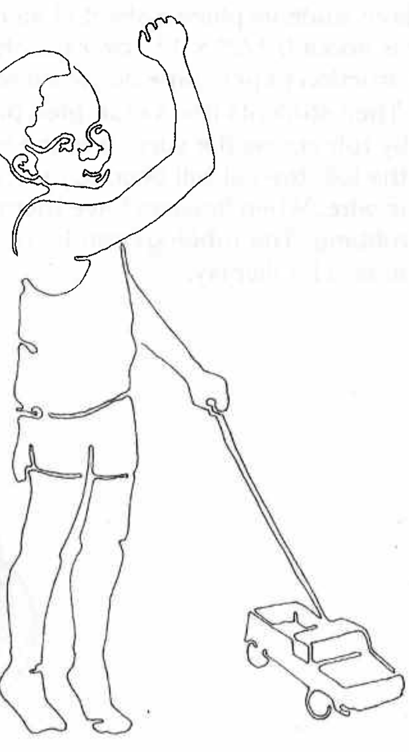
Materials: Spool of cotton-covered polyester thread, empty 1-gallon plastic milk jug with a screw-on lid, sand, a table with legs or other heavy furniture to which thread can be tied.

1. To make a model tram, fill a 1-gallon milk jug about half full of sand. Screw the lid back on the jug tightly and secure it with tape.

2. To make a model tramway, tie one end of a long thread to a table leg, then push the other end of the thread through the handle on the milk carton and tie it to another table leg 1 or 2 inches lower than the first end. Tie the thread so that it is taut, but not stretched too tight. It should be at least 3 feet from the floor since the string will stretch. You will need at least 2 people to do this, as one needs to hold the milk carton up, while the other ties the thread.

3. Before releasing the milk carton have students predict whether or not the thread will break. Then have a student pull the carton near the higher end of the thread and release it. If the thread can support the tram, it will travel down the thread to the other end.

4. If the thread breaks (it should) repeat Steps 2 and 3, but using a double strand of thread (twist 2 strands together). If the double strand breaks have students try again with 3 strands twisted together, and if necessary 4 or 5. Each time ask students to make a prediction.



Rubbing It In

Key words: *Metal, wire, ductile*

Concept: *Metal, including wire, is ductile.*

In addition to being strong, wire is very bendable, or ductile. Something is ductile if it can be easily bent or shaped. Wire is ductile because it is made of metal and most metals are ductile. Explore the ductility of aluminum foil and wire.

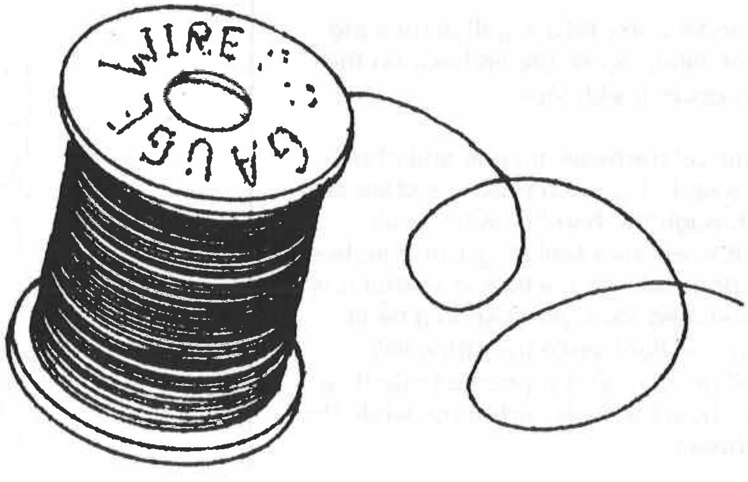
Materials: Thin wire (different types if possible) cut into pieces about 12" long (Choose soft wires that will not make a sharp point when cut. Check the ends after cutting and if necessary use sand paper to smooth them.), construction paper, tape, table or other flat surface, aluminum foil, paper towels, cardboard (optional).

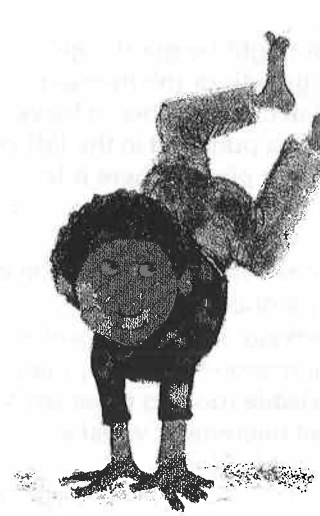
1. Have each student arrange pieces of thin wire on a 8 1/2" x 11" sheet of construction paper that has been taped down to a table. Have students bend and arrange the wire to make an appealing design or a picture, like a forest or a face. Encourage them to try overlapping some of the wires. Some of the wires may need to be taped down to hold everything in place. Also, have students tape down the ends of the wires so they don't poke through the aluminum foil when they make their rubbings.

2. Have students place a sheet of aluminum foil that is about 8 1/2" x 11" over the sheet of construction paper. Tape down the edges of the foil. Then students use a crumpled paper towel to gently rub across the surface of the foil. As they rub the foil, the foil will bend to match the shape of the wire. When finished have them remove the foil rubbing. The rubbings can be mounted onto cardboard for display.

3. Ask students the following questions about their rubbings:
- What did you do to the wire? (*Bent them into shapes.*) to the foil? (*Shaped it into a picture.*)
- Which kinds of wire were easier to bend? Which were difficult?
- What was similar about the wires and the foil? (*They are all made of metal. They can all be bent or molded into new shapes.*)

Teacher Note: Introduce students to the word "ductile." Explain that most metals are ductile meaning that they can be molded, bent, or shaped. Ask students to name some things that are ductile. (*Clothes hangers, pipe cleaners, paper clips.*) Ask them to name some things that are not ductile. (*String, dry sticks, shoe laces.*) As an extension ask students what it might mean if some said that another person was ductile. Explain that it doesn't mean that their body can be bent but that their ideas can be easily molded or changed.





Germs Make Me Sick!

(GPN # 34)

Author: Melvin Berger
Illustrator: Marilyn Hafner
Publisher: HarperCollins

Science Focused

Program Description: Our world is shared with millions of microorganisms, and although most of them are harmless, some make people sick. In this program, LeVar uses the world's best private eye, a microscope, to examine pond water. He also visits a microbiology lab to learn how scientists grow different kinds of germs.

Simple Microscope

Key Words: *microscope, image, lens*

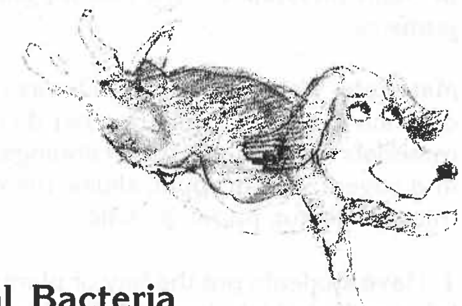
Concept: *A bulging drop of water can be used like a lens.*

Anton van Leeuwenhoek (1632-1723) built instruments that helped lead to today's microscopes. He used a single, small glass lens which he ground by hand. It is possible to simulate this kind of microscope by making a lens with water.

Materials: Safety pins, water, eye-dropper, magazine pictures (light colors work best), other visuals.

1. Using an eye-dropper, have each student place a drop of water on the bottom loop of their safety pin. This bulging drop of water acts as a lens.

2. Hold this lens very close to a picture and it will magnify the image (i.e. the dots that make up magazine pictures). If it is held further from the picture (or if the water drop is thinner in the middle than on the edges) the drop will make images look smaller. For best results, look straight down through the largest bulge of water.



Beneficial Bacteria

Key Words: *bacteria, beneficial, yogurt, culture*

Concept: *Some kinds of bacteria are beneficial.*

Many species of bacteria are beneficial. One example of this is yogurt which is a food produced by the growth of bacteria — Lactobacillus bulgaricus and Streptococcus thermophilus in particular. To make yogurt, active cultures are needed.

Materials: Plain yogurt (make sure the container states it contains active yogurt cultures), milk, powered milk, thermometer, heat source, quart jar with a tight seal.

1. Stir 1/2 cup of dry milk into 3 1/2 cups of milk.

2. Heat the mixture to 180° F (82° C) and then let it cool to 113° F (41° C).

3. Mix one tablespoon of yogurt (with active cultures) into a small amount of the milk mixture. Combine this with the rest and pour it into a very clean jar; seal it well.

4. Wrap the jar in several towels to keep it warm. Let it stand for 6-10 hours.

5. Have students sample the results. (Yogurt tends to be very tangy. It can be sweetened with honey or fruit.)

Observing Microorganisms

Key Words: microscope, microorganism, observation, protist, bacteria, virus

Concept: Like germs, other single-celled microorganisms called protists can be found in many places.

Microorganism cysts and eggs exist just about everywhere and can be activated by favorable conditions. This activity provides an opportunity to create an environment that supports microorganisms.

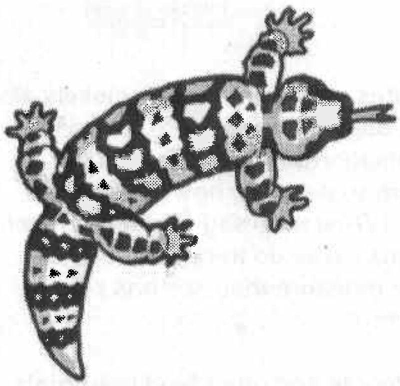
Materials: Water (let stand 24 hours to allow chlorine to escape), hay or other dead plant materials (dry leaves, grass clippings, etc), jars and covers, eye-dropper, slides, microscopes or microprojector, paper, pencils.

1. Have students put the hay or plant material they have collected into jars with water and observe how the jars look. Next view a water sample from the jar using a microscope or microprojector. They should document both of these initial observations.

2. After discussing what might be good conditions for supporting the growth of microorganisms, have each student decide whether to leave their jar covered (with holes punched in the lid) or uncovered, in a dark or light place, where it is warm or cool, etc.

3. Allow the jars to sit for several days. Then have them observe their jar and document these observations. Next, observing a sample of water from their jar using a microscope or microprojector, have them look for visible moving organisms (these will be protists, not bacteria or viruses which cause most disease infections).

4. Discuss how results varied depending on the plant materials used and the conditions chosen in step 2.



Gila Monsters Meet You At The Airport

(GPN #8)

Science Connected

Author: Marjorie Weinman Sharmat
Illustrator: Byron Barton
Publisher: Simon & Schuster

Program Description: LeVar learns more about the West when he joins a biologist who shows him around the Arizona desert. He finds out about desert plant and animal life—and what Gila monsters are.

Trying Drying

Key Words: desert, evaporation

Concept: Deserts have a high rate of evaporation.

Not only are deserts places that get very little water, they are also places where the rate of evaporation is high, so whatever rain might fall doesn't stay around very long. Explore conditions that increase evaporation.

Materials: Water, paper towels, student desks or tables, thin soft-cover books, two similar wide-mouth jars, rubber bands, area with direct sunlight, area away from sunlight.

1. Ask students to use a wet paper towel to dampen two spots on opposite corners of their desk.

2. Have them fan one corner of their desk with a book and compare the rate of drying on that side with the other. What happened? (*The side that was fanned dried faster, because the moving air carried away the water, which is what happens in evaporation. The other side of the desk dried slower because the air above it was still, so the moisture wasn't carried away as quickly.*) Explain that wind, which is moving air, is a condition that increases evaporation in the desert.

3. Next have students fill two similar jars with the same amount of water. Use rubber bands to mark the water level on each jar. Have them place one jar in direct sunlight, such as near an east-facing window, and the other in a place away from direct sunlight. Check to make sure that both jars are away from a heat source such as a radiator. Ask students to predict what will happen to the water in each jar.

4. For the next several days, have them use additional rubber bands to mark the new water levels on each jar. Ask them to identify which jar is losing water faster. Ask them to explain why. (*The jar in the direct sunlight is losing water faster. Direct sunlight and heat are other conditions that increase water evaporation in the desert.*)

No Loss

Key Words: *reptiles, body coverings, skin, condensation*

Concept: *People, unlike reptiles, lose water through their skin.*

Because water is so scarce in deserts, animals that live there have special adaptations to help them conserve body moisture. One characteristic that makes Gila monsters and other reptiles well adapted to desert life is their thick scaly skin. This skin holds in moisture and, as a result, less water is lost through their skin than that of people and other mammals.

Materials: Metal spoons, clear plastic bags (sandwich size or larger), tape.

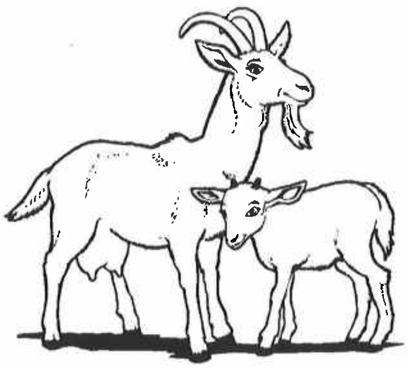
1. Have students blow onto the back surface of a shiny, dry, metal spoon. What happens? (*The surface of the spoon becomes foggy because moisture or water from their breath has condensed on the spoon.*) Explain that each time we breathe out we lose some water from inside our bodies. Gila monsters and other reptiles also lose water when they breathe. Many animals do. However, as mentioned in this episode, reptiles do not lose water through their skin.

2. Have students place their non-writing hand in a plastic bag. Then wrap a piece of tape over the bag at the wrist to seal the bag closed. Be sure that the bags are large enough so students can open their hands and that the tape is snug but not tight.

3. Tell students to look closely at the appearance of the inside of the bag. (*The bag should appear clear.*) Ask how the skin on their hand feels. (*The skin will likely feel dry and smooth.*) Have them go about their normal tasks.

4. After 15 minutes, ask them to look closely at the inside of the bags. (*They should see some moisture condensation similar to that on the spoon.*) Ask them to describe how the skin on their hands feel. (*They may say that it feels wet, sticky, or clammy.*) Why do they think this has happened? (*The moisture they see has come through their skin.*)

Science Note: People and other land mammals constantly lose water from their bodies in this way. Wearing long pants and long-sleeved shirts, as LeVar mentioned in this episode, not only helps protect a person from sunburn, it also helps conserve body moisture. The clothes keep the air above the skin still, and this decreases the rate of skin moisture evaporation. Reptiles lose less water because of their dry, scaly skin.



Science Connected

Gregory, The Terrible Eater

(GPN #11)

Author: Mitchell Sharmat
Illustrator: Jose Aruego & Ariane Dewey
Publisher: Simon & Schuster

Program Description: When visiting the San Diego Zoo kitchen, LeVar finds out about animal diets and learns that animals as well as people need a nutritionally balanced diet. He also visits Billy and Nanny's Barnyard Cafe for a snack, and joins three youngsters who cook a gourmet meal with a New York hotel chef.

Starch Energy

Key Words: *nutrition, carbohydrates, starch, iodine*

Concept: *Foods can be tested for starch, which is an important part of our diet.*

Unlike Gregory, about 60 percent of our diet is made up of carbohydrates, a high-energy food. Carbohydrates are organic compounds containing carbon, hydrogen, and oxygen. Two-thirds of the carbohydrates we eat are foods such as corn, potatoes, wheat, and rice which contain starch. Test foods for starch by using iodine tincture.

Materials: Iodine tincture (available at drug stores), food samples (such as breads, potatoes, apples, crackers, cheeses, cereals, potatoes, bananas, lunch meats, carrots, rice, celery, tapioca), small plates, table knife, **The Edible Pyramid: Good Eating Every Day** by Loreen Leedy (optional).

Teacher Note: Before beginning the activity, make it clear to students that food samples in this activity are not safe to eat. Iodine is a poison. It will also stain skin and clothing.

1. Cut up foods to make several small samples and put them on plates.

2. Explain that many foods we eat contain starch—which gives us energy. You can test foods for starch with a chemical called iodine. (A drop of iodine will form a dark purple color when a food contains starch.)

3. Have students test each sample for starch by placing a drop of iodine on it. After they have determined which samples contain starch, have them group all the samples with starch on one plate and those without starch on another.

4. Make a list of the foods that contained starch. Foods with starch are in a food group called carbohydrates, and it is recommended we have 6-8 servings of carbohydrates a day. Use the book **The Edible Pyramid: Good Eating Every Day** by Loreen Leedy to learn more about food groups and carbohydrates in particular. Ask students to estimate how many servings of carbohydrates they've had in the last several days. (This is easier if they begin by listing what they have eaten.)

Extension: Have students bring in food samples they think contain starch, test the samples and add them to the list if they do.

Slippery When Fat

Key words: *nutrition, fat, oils*

Concept: *Many foods contain fat.*

Gregory didn't seem to eat much fat, but many people do. Fat is a food group that includes foods like vegetable oil and butter. These foods are a good source of energy, but if your body doesn't use the fat, it will store it, and too much stored fat causes health problems. Some fat is found naturally in foods, but most of the time fat is added during the cooking process (such as in French fries, corn chips, etc.). Here's a simple way to identify foods that contain fat.

Materials: Foods containing fat (potato chips, chocolate candy, cake, nuts, cheddar cheese, cookies, corn chips), foods containing little or no fat (apple slices, orange slices, carrot sticks, pretzels, rice cakes), white typing paper cut into squares, pencils.

Teacher Note: Tell students not to eat the food samples.

1. Have students place a small sample of each food on a separate square of white typing paper.

2. At the top of each square, have them write the name of the food. Ask them to predict which foods they think contain fat and have them write an "F" on the bottom of those paper squares. (*A quick test for fat is to touch the food; if it leaves a slippery feeling on your fingers it probably contains fat.*)

3. After letting each food sample set on the paper for about 10 minutes, have them remove the food samples and throw them away.

4. The next day, hold the squares up in front of a light or bright window. The squares that have spots they can see light through are from foods that contain fat. Have students make a list of the foods they found to contain fat and those that didn't. (While this test is good at identifying foods that contain fat, a few foods that do have fat may not make a mark on the paper.)

Extension: Have students look at a variety of food package labels to see how much fat the foods contain.

Hill Of Fire

(GPN # 23)

Author: Thomas P. Lewis
Illustrator: Joan Sandin
Publisher: HarperCollins

Science Connected

Program Description: At Volcano National Park in Hawaii, LeVar is only 2,000 feet from a major eruption of Kilauea volcano. As he talks to volcanologists, he finds out what is inside the earth that causes volcanoes, and discovers how they are learning to predict eruptions. He also visits an artist who creates raku pottery.

Volcanic Crayons

Key Words: volcano, eruption, heat, pressure

Concept: Volcanoes are caused by heat and pressure under the surface of the earth.

LeVar seemed very excited watching Mount Kilauea erupt. It is a sight few people get to see in person. Volcanoes only erupt when melted rock from deep inside the earth is forced up to the surface. This is caused by the enormous heat and pressure created by gravity. Create a miniature model of a volcano erupting.

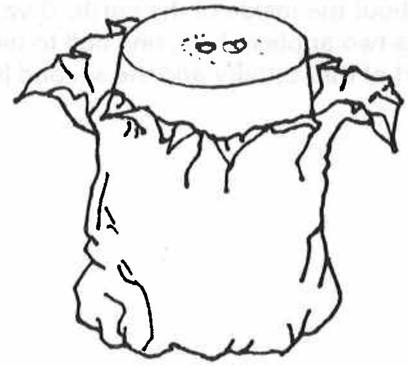
Materials: Paper cups, unwrapped red crayons that are about an inch shorter than the cup, plaster of Paris, water, table knives, aluminum foil, pan, stove or hot plate.

1. Mix up enough plaster of Paris so that each group of students will have about one cup of the mixture.

2. Have each group hold two crayons in the center of a paper cup with the crayon tips pointing straight down (make sure that the crayon tips are touching the bottom of the cup), and fill the cup with plaster of Paris so the crayons are completely covered.

3. A day or two later, after the plaster has completely dried, have students tear away the paper cup from around the plaster and turn it over so the small end is up. Use a table knife to scrape away the plaster from above the crayon tips, cautioning students to make only a small opening above the tips.

4. Have them set their plaster model on a piece of aluminum foil, and fold the foil loosely up around the sides, leaving the top of the model uncovered.



5. Put the foil wrapped plaster model in a pan. Making sure water does not flow over the top of the foil, add water to about 1 inch below the top of the model. Set the pan over high heat, reminding students not to touch the pan or the heat source. Ask them to predict what will happen to the crayons. (*As the crayons melt, which may take 10 minutes or more depending on the heat source, they will expand and simulate a slow volcanic eruption.*) Then ask students to describe what happened to the crayons. (*Because the crayons were sealed inside the plaster models, the liquid was forced out the top.*) Explain that this action is similar in volcanoes. The heat and pressure inside the earth heats rocks near the surface, as the rocks melt, they expand and molten rock is forced out of the volcano.

The Big Apple

Key Words: *volcano, crust, mantle, core*

Concept: *Volcanoes help us understand the inside of the earth.*

Because molten rock or lava travels up to the surface from deep inside the earth, volcanoes provide valuable information about the earth's interior.

Materials: Apples, large cutting knife, vegetable peelers or table knives, paper towels, tempera paint, paper, marking pens.

1. Use a large knife to cut apples in half (a single downward slice will insure that there is a flat, even surface). Make sure you cut through the center core of the apple.

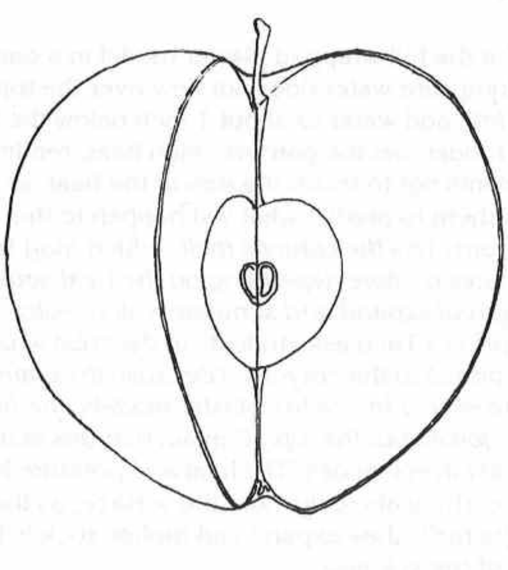
2. One way geologists, scientists who study the earth, have learned about the inside of the earth is by studying volcanoes. Ask students what they know about the inside of the earth. Give pairs of students two apple halves, one half to use in the first part of this activity and the second half for later.

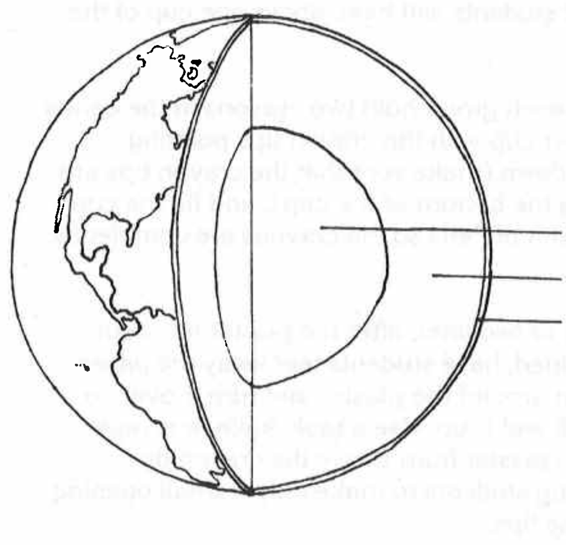
3. Have students look at the apple half as a cross section model of the earth beginning with the ***crust***. *The peeling of an apple is similar to the crust, which is the thin, top layer of the earth that we live on. It is only about 20 miles deep and mostly made of granite.* Ask student to begin to "dig" into their model of the earth using a vegetable peeler or table knife to cut away the earth's crust.

4. The next layer of the earth is called the ***mantle***. *Volcanoes occur when magma from the mantle breaks through the crust. The mantle is much thicker than the crust; it is about 1,800 miles deep. It is made of rocks and minerals (mainly magnesium and iron silicates).* Ask student to cut away the mantle layer, down to the center.

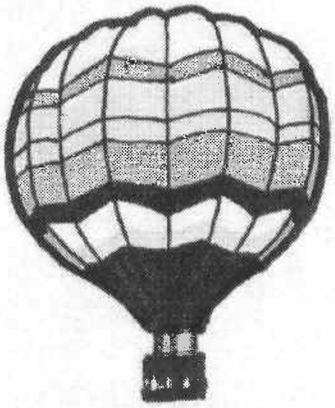
5. The layer in the center of the earth is called the ***core***, just like the center of an apple. *The core of the earth is about 2,200 miles thick, just a bit thicker than the mantle. Geologists think that it is made of metals, mostly iron and some nickel.* Ask students why they think geologists might not know as much about this part of the earth. (*It is very deep in the earth.*)

6. With the other half of the apple have students make an apple print by dipping the cut surface in tempera paint and pressing it on a sheet of white paper. After the prints have dried, have them draw and label the print with the three layers of the earth.





Science Connected



Hot-Air Henry

(GPN #16)

Author: Mary Calhoun
Illustrator: Erick Ingraham
Publisher: Morrow

Program Description: LeVar experiences a colorful and exciting expedition in a hot-air balloon, takes a look at some comical flying machines of the past that never made it off the ground, and visits the National Space Camp where kids find out what it takes to become an astronaut.

On The Rise

Key Words: air, gases, temperature

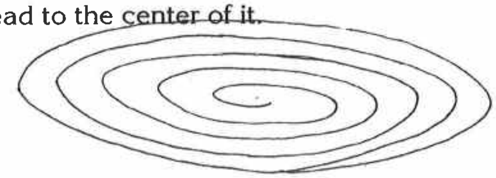
Concept: Warmer air rises.

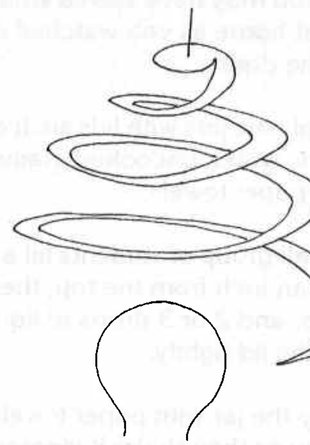
As Hot-Air Henry learned, pulling on the burner cord made the hot-air balloon rise, and opening the top of the balloon made it descend. This is because the burner fire warmed the air inside the balloon and, since warm air rises, the balloon rose. Releasing the warm air and allowing the outside cooler air to enter the balloon caused it to descend.

Materials: 8" construction paper circles with centers marked, scissors, tape, 12" pieces of thread, 100-watt light bulb, lamp without a shade, electrical source.

1. Discuss what Hot-Air Henry did to make the balloon rise and descend. Explain that warmer air rises and that cooler air sinks. Ask students to explain why the balloon rose and fell. (*The burner warmed the air, causing the balloon to rise. Opening the hole in the top of the balloon released the warm air causing the balloon to descend.*)
In this activity students won't be able to see the warm air rising but they will be able to tell that it is by seeing its effects.

2. Have each student cut a spiral shape from construction paper, and tape the end of a piece of thread to the center of it.





3. Discuss the changes in the temperature of a light bulb when it's on compared to when it's off. Ask them to predict what will happen to the temperature of the light you'll be using when it's turned on. (*The temperature around the light bulb will become warmer.*)

4. One at a time, have students hold their spiral several inches above a cool light bulb. Then turn on the light (reminding them not to touch the bulb) and have them try it again. After a moment the spiral will start to spin slowly. Ask them why this happened. (*Warm air rising above the light pushes up on the spiral causing it to spin.*) Have them try it away from the light and again over the lighted bulb, reminding them to steady the spiral after each move. Ask them why the spiral does not spin when it is away from the light. (*There is no warm rising air to push it.*)

Extension: Ask students to think of other places where warm air might be rising, such as above a radiator or above a sunlit, dark-colored, countertop. (Forced-air heaters are not good examples since air movement is caused by a fan.) Have them use their spiral to test if their predictions are correct.

Mini-Tornado

Key Words: air currents, tornadoes, vortex

Concept: Rapid movement of air or water can create a vortex.

Hot-air balloons drift along on air currents caused by the movements of warm and cold air. Most air currents are gentle but they can be very forceful, as in the case of a tornado. A tornado is the result of a large amount of moving air coming together in one place. The air develops a spinning motion called a vortex. You may have seen a small vortex in your bathtub at home as you watched spinning water go down the drain.

Materials: Wide plastic jars with lids such as a peanut butter jars, water, uncooked grains of rice, liquid dish soap, paper towels.

1. Have each small group of students fill a plastic jar with water to an inch from the top, then add a few grains of rice, and 2 or 3 drops of liquid soap before securing the lid tightly.

2. Have them dry the jar with paper towels, and hold the jar tightly as they shake it vigorously in a circular motion.

3. After shaking the jar have them quickly place it on a table and observe the motion of the water and air. The movement in the jar will form a mini-tornado, which is made more visible by the soap and rice. This spinning water is called a vortex and it is similar to a tornado, which is rapidly spinning air. Before repeating the activity, students may need to scoop some of the soapsuds out of the water.

How To Make An Apple Pie And See The World

(GPN #118)

Science Focused

Author: Marjorie Priceman
Publisher: Knopf

Program Description: The art and science of cooking are deliciously mixed in this episode as LeVar and chef Kurtis Aikens use their science knowledge to cook up a meal. The cook in the feature book, **How to Make an Apple Pie and See the World,** needed more than science knowledge to bake her pie. She ended up needing a bus, an airplane, and a banana boat as she traveled the world to collect the finest ingredients for her recipe.

White Out

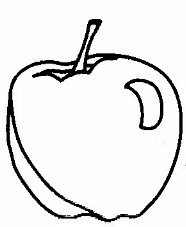
Key Words: *mixing ingredients, reactions, observations*

Concept: *Ingredients used in cooking may look similar but have different properties that can be described.*

As LeVar and chef Kurtis Aikens were cooking, it was clear that they knew a great deal about the ingredients they were using. To learn about ingredients, chefs must be excellent observers of how different ingredients react with each other. Not all ingredients that look similar react in the same way when mixed with other ingredients.

Materials: Labeled tablespoon samples of salt, flour, and baking soda in small paper cups, large sheets of plain paper such as 11" X 18" white construction paper, pencils, hand lenses, brown paper towels or squares of dark paper (about 10" X 10"), clear plastic glasses, water, spoons, white vinegar, and unlabeled samples of salt, flour, and baking soda in small paper cups.

1. Give small groups of students labeled samples of each of the three white, powdered cooking ingredients (salt, flour, baking soda). Explain to students that although the samples look similar, they are really very different. Have students read the labels on the samples and tell what they know about each.



2. Have each group make a chart on a large piece of paper with the following headings across the top: *Sample, Look, Water, Vinegar* and down the first column: *Salt, Flour, Baking Soda.*

Sample	Look	Water	Vinegar
Salt			
Flour			
Baking Soda			

3. Have students place about 1/2 teaspoon of each sample onto a brown paper towel using a spoon (wiping the spoon clean after placing each sample). Next have them look at the samples with a hand lens and write a description of each in the first column of their chart.

4. Then ask students to mix about 1/2 teaspoon of salt into a glass containing 1/4 cup of water, stir the mixture and clean the spoon. After observing the reaction, they should note on their chart how the sample behaved when mixed with water. Repeat the procedure with flour and baking soda.

5. Repeat Step 4 using vinegar in place of water.

6. Ask students to use information on their chart to describe ways in which the samples are alike *(i.e. salt and baking soda both dissolved in water)* and different *(i.e. only the baking soda fizzed when mixed with vinegar).* Then give each group a mystery sample (salt, flour, or baking soda) in an unmarked cup. Ask the students to identify the sample using the information they've noted on their chart. Remind them to look at the sample, mix it with water, and mix it with vinegar before drawing a conclusion.

Enough Dough For Everyone

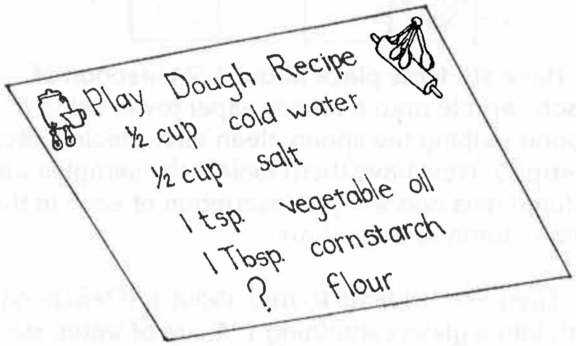
Key Words: problem solving, measurement, mixing ingredients, observations

Concept: Combining ingredients in different amounts produces different results.

LeVar states that cooks, like scientists, must make careful measurements and mix ingredients in the correct amounts to get the results they want. Experiment to determine the correct amount of flour for this playdough recipe.

Materials: Note cards, pen, measuring cups, measuring spoons, food coloring, cold water, salt, vegetable oil, cornstarch, flour, large mixing bowls, paper towels, paint shirts or aprons, large spoons, table knives, small bowls, plastic bags.

1. Copy the recipe for playdough onto cards for students. Tell students that they will be experimenting to find the best amount of flour for the recipe. Ask students to predict what might happen if they add too little flour; or too much.



2. Have students put on paint shirts. Then give each group of students a large mixing bowl, a large spoon, 1/2 cup cold water, 1/2 cup salt, 1 tsp. vegetable oil, and 1 Tbsp. cornstarch. Have them pour all the ingredients into the large bowl and mix them together. Make each group's playdough a different color by adding about 10 drops of food coloring to their mixtures.

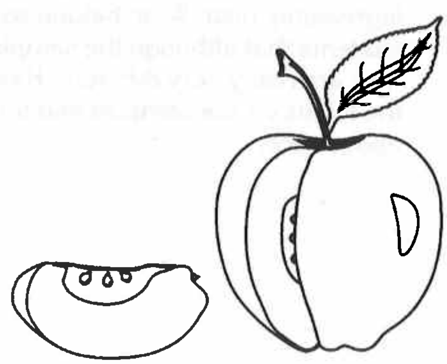
3. Give each group a bowl containing 2 cups of flour, a 1/4 cup measuring cup, a spoon, and a table knife. Show students how to fill the measuring cup with flour using the spoon and then level off the top with the knife. Tell students to begin by adding just one 1/4 cup of flour into their mixture and stir it in completely. Have them record this by drawing a picture of one measuring cup on the back of their recipe card.

4. Ask each group to decide if their mixture needs more flour. If they think it does, have them add another 1/4 cup of flour and record this by drawing another picture of the measuring cup. Have each group continue to add flour, 1/4 cup at a time, until they feel the playdough is the right consistency for molding. As the mixture becomes stiff, students may need to use their hands to mix in the flour. Encourage them to describe how the mixture changes as they add more flour.

5. When their playdough is done, help each group find the total amount of flour for their recipe by totaling the number of 1/4 cups used. (Most groups will use 1 to 1 1/2 cups of flour.) Ask students to explain how they knew when their playdough was done by describing how it looked and felt.

6. Have the students work or "play" with the dough. Ask them to examine and describe the playdough made by the different groups. Some may be soft or firm, smooth or bumpy. Encourage students to look for advantages to each. For example, one may be easy to clean-up because it doesn't stick, another may be good for making shapes because it is soft . Store the playdough in plastic bags.

(See ***The Bread Of Life*** next page)



The Life Of Bread

Key Words: *preservatives, bread, food additives, consumer awareness*

Concept: *Preservatives are added to foods to keep them fresh longer.*

The cook in this episode's feature story went all around the world to get the finest ingredients for her recipe. Most of us do our shopping at a local market. However the foods there will have been picked or prepared a day or more ago. To keep these foods fresh tasting, many prepared foods like bread have more than spices added to them, they have preservatives. See how preservatives increase the shelf life of bread.

Materials: Commercial bread (often white bread) containing a preservative (such as calcium propionate or sodium propionate), commercial or homemade bread without preservatives, two shallow pans, water, plastic wrap, paper, pencil, food labels.

1. Show students the labels (or label and recipe card) from the two breads. Have them compare the ingredients in the two loaves. Explain that in addition to the ingredients used to make bread, one contains an ingredient that was added to keep the bread fresh longer. Explain that this is called a preservative.

2. Have students sprinkle a few drops of distilled water on a slice of the bread containing preservatives, place it in a pan, and then cover the pan with plastic wrap. Label this pan as the one with preservatives. Do the same with a slice of bread that does not contain preservatives and label it as not containing preservatives.

3. Have students place the pans on a shelf in a dark cupboard. Ask students to check the pans each day for a week and record any changes they observe in the appearance of the bread slices. After four or five days the bread that does not contain preservatives should begin to have mold growing on it. Several more days will pass before the slice of bread containing a preservative begins to mold.

4. During this time, have students bring food labels from home. Make a list of additives identified on the labels as preservatives. (Some additional examples are sodium nitrate, sodium benzoate, potassium sorbate, and butylated hydroxytoluene or BHT.) Explain to students that although preservatives are very helpful in extending the amount of time a food can be eaten, some people worry about the health effects of adding chemicals to foods. For this reason the Food and Drug Administration is continually testing food additives to make sure they are safe. Ask students to consider which of the two breads tested, they would choose to buy.

Extension: Repeat the activity and place the bread slices in a refrigerator. Students will find that the shelf life of the bread is greatly increased.

It's In The Milk

Key Words: *milk, protein, acids*

Concept: *Milk contains protein.*

Milk, no matter where you get it, is a very common ingredient for cooking in North America. Milk contains protein which is an important part of our diet and an important part of many recipes. Batters made from eggs and milk, both of which contain protein, become solid when heated.

Materials: Vinegar, clear plastic cup, milk, spoon.

1. Have students put two teaspoons of vinegar, which contains a weak acid, in a clear plastic cup.

2. Have them put 1/2 cup of room temperature milk into the vinegar, stir, and put the mixture aside for about 10 minutes.

3. Have the students look at the milk again. Ask them to describe how the milk has changed. (*It has become a liquid containing solid clumps.*) Explain that the protein in the milk has been changed by the acid in the vinegar. Milk contains many small solid particles that are evenly spread throughout the liquid. Vinegar causes the small particles to clump together. Explain that the solid clumps are called curds and the remaining liquid part is called whey. Have students try to stir the milk and make the curds disappear. (*They will not be able to. Once the protein has been changed it cannot be changed back.*)

C To See

Key Words: *apples, reactions, preservatives, vitamin C, enzymes*

Concept: *Vitamin C keeps apple slices from browning.*

The apples LeVar used looked very fresh, but as soon as he cuts them they will begin to brown. Learn a simple trick for preserving fresh cut apples.

Materials: Apples, table knives, plates, lemon juice, vitamin C tablets, cutting board, large wooden spoon, paper, pencil.

1. Have students cut an apple into slices and place the slices on three plates.

2. Have students label the first plate by writing "Plain" on a sheet of paper and placing it near the plate.

3. Have students sprinkle some lemon juice on the apple slices on the second plate and label it "Lemon juice".

4. Have students place a vitamin C tablet on a cutting board and crush it using a large wooden spoon. Then sprinkle the crushed tablet on the apple slices on the third plate and label it "Vitamin C".

5. Ask students to predict what might happen to the apple slices on each plate, then set the plates aside. After about an hour have the students look at the slices again. Compare the appearance of the slices on each of the plates. (*The "plain" slices will be browner than the others.*) Help them understand that the Vitamin C in the tablet and in the lemon juice kept the slices from turning brown. Explain that a substance, like vitamin C in this example, which increases the amount of time it takes a food to spoil is called a preservative. Ask students what they might do if they made a salad that contained apple slices? (*Sprinkle lemon juice or vitamin C on the slices to keep them from browning.*)

Science Note: The ascorbic acid (vitamin C) in lemon juice is a natural preservative. When some fruits (such as apples, pears, and bananas) are peeled and exposed to air, enzymes in the fruits begin to react with oxygen in the air destroying fruit cells and causing the fruit to turn brown. The ascorbic acid reacts with the enzymes before they can start destroying the fruit cells.

Spice Of Life

Key Words: *spices, observations, smell, parts of plants*

Concept: *Spices, which are used to enhance the smell and taste of food, come from plants.*

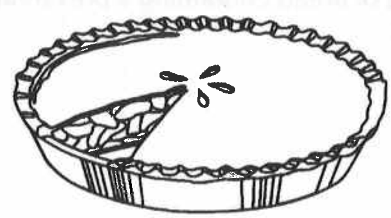
In the story, **How to Make an Apple Pie and See the World,** the cook goes to Sri Lanka to collect cinnamon. She finds that cinnamon, like all spices, is part of a plant — in this case the bark of a kurundu tree.

Materials: White school glue, index cards, marker, squares of light cotton cloth about 8" X 8", cotton balls, whole spices (such as cinnamon sticks [bark], whole cloves [seeds], cardamom seeds, whole nutmeg [seeds], caraway seeds, cumin seeds, dried coriander leaves, dried parsley leaves, bay leaves), 10" pieces of ribbon, egg cartons, scissors, tape, paper, pencils.

1. To make a set of spice cards for each group of students, glue small samples of all the whole spices onto separate index cards. Label the cards with the names of the spices. To make a spice tray for each group, cut the tops off several egg cartons so that you have just the bottom trays. Pour samples of the spices into the egg cups so that each tray has samples of all the spices.

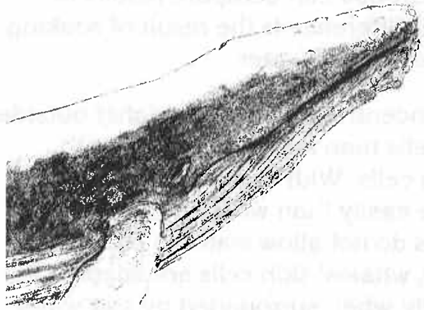
2. Give each small group of students a set of spice cards and some hand lenses. Have students look at the spices glued on the cards. Help them recognize that all the spices are parts of plants such as seeds, leaves, and bark. Depending on the number and kinds of spices used, you may want to have students try grouping the spices by what part of a plant they come from.

3. Tape a spice tray down in the center of each group's work table. Have them use the hand lenses and the cards to identify the spices in each of the egg cups. Encourage students to smell the spices (but not taste) by pinching a small amount between their thumbs and index fingers, and then returning the spice to the egg cup. Explain that spices are used in cooking to enhance the taste and smell of foods.



Humphrey The Lost Whale: A True Story

(GPN # 56)



Author: Wendy Tokuda & Richard Hall
Illustrator: Hanako Wakiyama
Publisher: Heian International

Program Description: Humpback whales, like many birds, migrate yearly. They travel between the cool waters of the north and the warmer waters near the equator. Humphrey is a real whale who lost his way by making a wrong turn into the San Francisco Bay. Inspired by these yearly migrations, LeVar spends a day at sea whale-watching and learning more about these sea mammals.

Finding Your Way

***Key Words:** geography, location, migration, landmark, route*

***Concept:** Like many animals, whales migrate through the season.*

Humphrey became separated from his pod during the long migration humpback whales make each year. Many animals migrate long distances without getting lost.

Animals find their way along their migration path in many ways, including using familiar landmarks. Create a simulated migration route using identified landmarks.

Materials: craft sticks, pencils, writing paper.

1. Choose a code word for each group of 2-3 students. Have them print that word on 8-10 craft sticks and number the sticks.

2. Have each group of students use these (in numerical order) for landmarks as they create a migration route in the school yard. Establish a beginning and ending point for the activity, and encourage each pod to create their own route between these points.

3. Later in the day, groups can retrace their migration route, collecting the sticks in order. Discuss how the landmarks helped them find their route.

Extension: Students can repeat the process by creating a new route, then drawing a map and writing a description of the route. Groups can exchange information and use it to follow the route — reclaiming the landmark sticks as they go. Discuss what clues were the most helpful in discovering the unknown route.

(See ***Sea, The Water Is Really Different*** next page)

Sea, The Water Is Really Different

Key Words: *salt water, fresh water, blubber, density, floating*

Concept: *Salt water is more dense than fresh water.*

One reason that whales can grow so large is that the water helps hold up their bodies. Whales have a layer of fat (blubber) that is less dense than water. This blubber helps them float. Living in salt water also helps because salt water is more dense than fresh water — so objects float more easily. Since Humphrey swam into fresh water, people worried that he might have a harder time reaching the surface to breathe than he had in the salt water of the ocean.

Materials: Water, salt, two similar containers, two boiled eggs, writing paper, pencils.

1. Pour 2 cups of water each into 2 identical containers; dissolve 3 tablespoons of salt into the water of one container.

2. Gently put a boiled egg in each container.

3. Observe and record what happens. *(Salt water is more dense than fresh water, it provides a greater buoyant force so the egg in the salt water will float.)*

Skin Deep

Key Words: *cells, cell function, concentration*

Concept: *Water moves into and out of cells depending on the concentration of dissolved solids, such as the salt in salt water.*

Like all living tissue, skin is made of cells and cells function differently in salt water than in fresh water. Some biologists were worried that Humphrey's prolonged exposure to fresh water might make his skin become less healthy.

Although plant and animal cells are very different, the way cells generally function in salt water can be observed using some vegetables.

Materials: Water, salt, paper cups, celery or carrot sticks.

1. Put water in 2 cups and dissolve a tablespoon of salt in one, then place a carrot or celery stick in each cup.

2. After an hour or more, remove the vegetable sticks and bend them slowly. Have students note the difference. Groups can compare results to confirm that the difference is the result of soaking in fresh water versus salt water.

Because the concentration of salt is higher outside the vegetable cells than inside, water tends to move out of the cells. With less water in them, the cells bend more easily than when they were full of water. Skin cells do not allow water to pass as easily; however, whales' skin cells are adapted to function properly when surrounded by salt water and it was not known if this functioning might change in fresh water.

Hungry Humphrey

Key Words: *crustacean, food, baleen, filter*

Concept: *Baleen whales eat by filtering food out of water.*

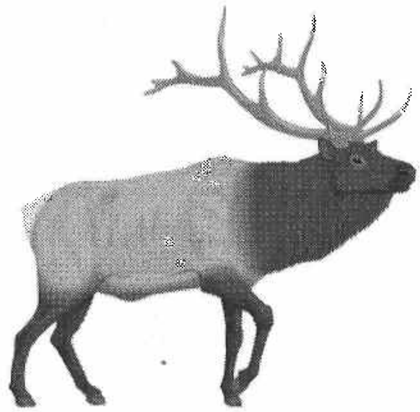
We often assume that large animals eat large food. In fact, whales — one of the world's largest creatures, eat krill — one of the world's smallest creatures. Krill are crustaceans as are shrimp, crabs and lobsters. Since krill are so small (3/8"-6" or 10-150 mm), whales need to eat a large number of them. Krill swim in schools of many hundreds of thousands so whales often catch them by swimming up from below and trapping many of them at a time in their large mouth. In this process, whales also catch a great deal of water which they squeeze out of their mouth through a fibrous substance called baleen. The baleen hangs from the whale's jaws in place of teeth and acts as a filter to hold the krill in as the water goes out. Use a comb to experience how baleen works.

Materials: Large bowl or tub, paper-punch dots, comb, water, paper, pencil.

1. Fill a large bowl or tub with water and put in some paper-punch dots.

2. "Catch" the dots by using the comb to scoop through the water. Count and record the number of dots strained out each time.

3. Experiment with methods (such as stirring, moving up from below, or moving in from a side) to catch more dots at a time.



Imogene's Antlers

(GPN #33)

Author: David Small
Publisher: Crown

Science Connected

Program Description: In a trip to the Philadelphia Zoo, LeVar explores why animal looks and shapes are important to how they live—and discovers the difference between horns and antlers. Then a bird specialist introduces some unique birds, and some unique string band members explain how they dress in feathered costumes for the Philadelphia Mummers Parade.

Pin It On Me

Key Words: *animal characteristics*

Concept: *Different kinds of animals have different characteristics.*

Imogene's brother, Norman, was interested in just what kind of antlers Imogene had grown. He used characteristics of the antlers to help identify them. All animals have characteristics that make them unique. It is these characteristics that biologists use to identify and classify animals.

Materials: Index cards, drawing pen, safety pins or tape.

1. Write the names or make drawings of several common animals on index cards, such as horse, elephant, whale, spider. Make one card for each student playing the game, plus a few extras.

2. Using safety pins or tape, attach one card onto the back of each student.

3. Explain to students that they are to try to find out as much as they can about their animal by asking another student three questions that can be answered with either "yes" or "no." Ask students to discuss the kind of Yes/No questions that might be most helpful. Help students to understand that in the beginning the most useful questions are broad questions about animal characteristics, such as "Does my animal have fur?" or "Does my animal live in fresh water?" After they have gathered some information, more specific questions are helpful. Explain to students that people who study animals ask the same kinds of questions when they identify an animal.

4. Ask each student to carefully think of three questions and if students are able to, have them write the questions down on a sheet of paper. Remind students that their questions must be answered with either "yes" or "no."

5. Have students turn around to show a classmate their animal card and ask their three questions. Next, students can either think of three more questions or, if they think they know what their animal is, they can make a drawing of it. Students who make a drawing should show it to an assigned judge to determine if it is the correct animal. If it is correct and time allows, they can be given a new card and begin the game again. If it is not correct, they need to ask more questions.

Get Into Shape(s)

Key words: animal, characteristics, body

Concept: Many animals can be identified by their shape.

Shape is one of the easiest characteristics to use when identifying an animal. Long or flat, fuzzy or pointed, fined or feathered, all animals have a unique shape. Appendages, such as legs, wings, and fins are key elements of an animal's shape.

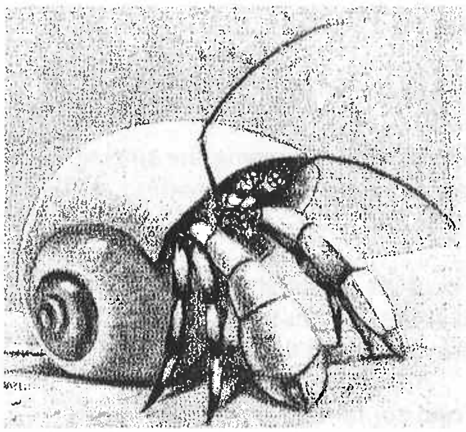
Materials: Pictures of animals cut from magazines or photocopied from books (the pictures should contain some background, such as trees or grass), tracing paper, colored construction paper, scissors, glue, marking pen.

1. Make animal cards for students by mounting pictures of animals onto pieces of construction paper. Label each picture with the name of the animal. For an easier game, choose very different shaped animals—such as a deer, a peacock, a shark, a butterfly, etc. For a more challenging game, choose similar animals—such as different kinds of deer and elk.

2. Using tracing paper, make a silhouette of each animal. Cut out the silhouette and place each on a separate piece of construction paper. For an added twist, reverse some of the silhouettes by flipping them over and then gluing them down.

3. Ask pairs of students to match each animal card to its shape (silhouette). After students have finished, ask them to a make an additional pair of cards to add to the game.

Extension: Have students can be asked to group the animals by shape, body parts, size, or some other characteristic.



Is This A House For Hermit Crab?

(GPN # 98)

Author: Megan McDonald
Illustrator: S.D. Schindler
Publisher: Orchard Books

Science Focused

Program Description: For a hermit crab finding the right home is particularly important since that home is carried around on its back. This show takes a light-hearted look at animal habitats, and LeVar has a good time building a house for his favorite flying friends.

Get The Spotters Out

Key Words: *wildlife, habitat, human impact*

Concept: *We can make an effort to spot wildlife around us and use our observations to consider the impact we have on wild animals.*

Most animals have a place to sleep and to raise their young — spaces we'd call home. But they also have neighborhoods — areas where they find food, water, and other things they need. For some animals this is a few square feet around its shelter, for others it is an area that extends for miles.

Some people make a hobby of spotting wildlife in the animal's "homes" or "neighborhoods". A spotter needs keen observation skills, a respect for animal safety and a method for tracking what they've seen.

Create a class spotter center where students can write simple reports sharing information about the wildlife they see in the area.

1. Decide what should be included in a spotting report, such as a description of the animal, when it was seen, where it was seen, and perhaps information about whether or not someone is likely to spot the animal again (e.g. was the bird building a nest or was it migrating). From this information create an outline spotters can follow when writing reports.

2. Create a spotting center (a bulletin board, shelf or box with folders) where the spotting reports are available to others. Decide how to organize the reports — by location in relation to the school, by type of animal, or in some other way.

3. There are opportunities to spot wildlife during recess and on the way to and from school. As spotter reports grow in number, look for trends in the information. What kinds of animals are spotted most often? (Probably birds and insects.) Where are most of the sightings? (Probably around natural habitat areas such as bushes and trees.) What are the animals doing when they are spotted? (Often resting or eating.) It might also be interesting to discuss the impact people are having on the wildlife that has been spotted.

Home, Many

Key Words: *home, shelter, food, water*

Concept: *An animal is at home wherever it finds food, water and shelter to meet its needs.*

Materials: Chalkboard and chalk, or chart paper and markers

As the class generates names of animal homes (i.e. den, nest, burrow, lodge, mound, hive, hill, web, hole), write them on a chalkboard. Next determine what animals live in these homes.

Not all animals (e.g. butterflies, many fish, insects, deer, and whales) have a single home. Depending on their needs, these animals may move to a variety of places in order to find shelter, food, water.

Is This A Home For...?

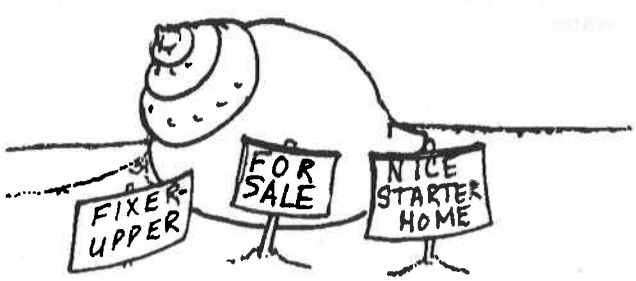
Key Words: *home, shelter, food water*

Concept: *An animal is at home where it finds food, water and shelter to meet its needs.*

Materials: *3"x 5" cards, crayons, nature magazines for cutouts (optional), scissors, glue*

1. Have students make pairs of picture cards by drawing or mounting magazine pictures of an animal on one 3" x 5" card and the animal's home on another card. (Homes might be as big as a forest for a deer, or as small as a niche in a rock for an insect.)

2. Use the cards to play a matching game. Two or three students combine their animal home cards and spread them out picture down, then combine their animal cards and do the same. Players take turns turning over a home card and then turning over an animal card while saying, "Is this a home for ___ ?". If the other players agree it's a correct match, the cards remain face up. If not, the cards are turned picture down. Players continue taking turns until all cards are face up.



Home Tweet Home

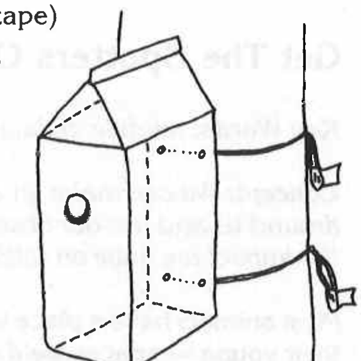
Key Words: *shelter*

Concept: *We can help overcome the stresses caused by human activities by creating artificial shelters for wildlife.*

Bird houses provide a safe shelter from the weather, and safety for nestlings. Make a bird house out of a discarded container.

Materials: Food containers (half-gallon size — avoid those with chemical residues, e.g. laundry detergent), scissors, light bendable wire, waterproof tape (e.g. duct tape)

1. Rinse the container well. Cut an entrance hole (1" to 1-1/2") about two-thirds of the way up the container, making sure there is plenty of room below the hole for the nest. (See illustration.)



2. On the back side (opposite the entrance hole), punch two small holes near the top of the container and two near the bottom. Thread one piece of wire through the top two holes and another through the bottom holes. Make the wires long enough to secure the container to a tree or post.

3. Sprinkle dried leaves and very thin twigs in the container, and tape it closed. Tape any seams that might let in water or wind; only the entrance hole should be left open.

4. Mount the bird house on a sturdy post or tree, at least 5'-6' off the ground. Wrap the wires around the post or tree and twist them so they will hold the house in place. (Make sure the wires don't cut into the bark.) Bend the ends of the wires so they are flat against the tree or post and cover them with tape.

Each winter, after the birds leave, remove the house and repair or replace it. The wires should be discarded if they are rusted or worn from being twisted.

Home Away From Home

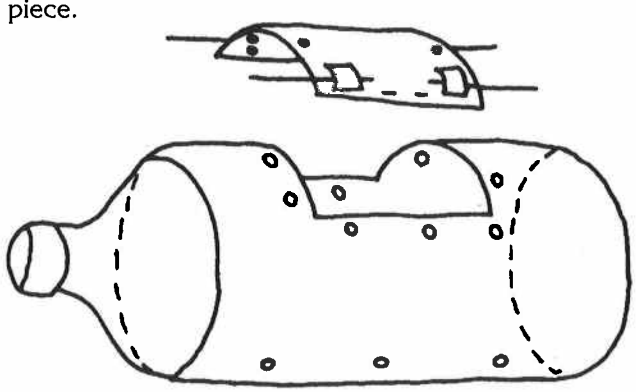
Key Words: *terrarium*

Concept: *A terrarium, that is modeled after an animal's natural home, can be used to keep the animal alive and satisfied for short periods.*

Provided with a suitable home, some types of wildlife can safely visit the classroom for a closer look. This terrarium is a suitable home for several kinds of small animals — including crickets, land snails, slugs. When the visit is over, release the animal in the natural place it was found.

Materials: 2-liter clear plastic soda bottle with cap, permanent marker, sharp scissors or craft knife (for teacher use), pebbles (1/4"-1/2" in diameter), 4 toothpicks, hand paper punch, tape, soil; and, depending on the animal needs: grass seed, small stones, dry leaves, short twigs

1. Create an opening in the soda bottle. Draw a 6"-8" line down the side of the bottle. Draw an identical line 4" around the bottle from the first. Lay the bottle on its side and connect the top ends of each line by cutting a slit along the curve of the bottle between them. Do the same at the bottom. Complete the opening by cutting along each of the drawn lines and removing the rectangular piece.

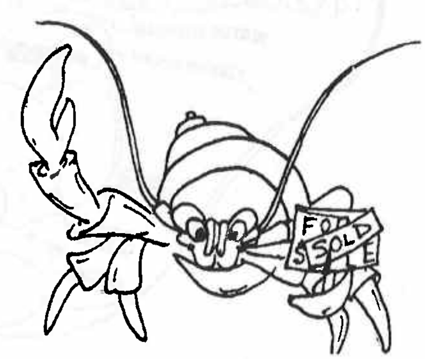


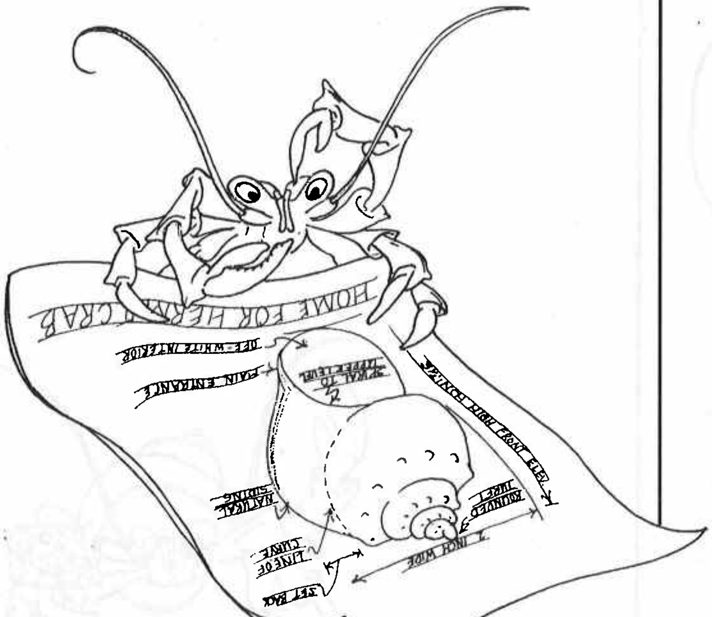
2. Create a cover by taping a toothpick to the corners of the rectangular plastic piece. The toothpicks will keep it from falling into the bottle.

3. Punch several air holes around the edge of the opening and around the edge of the cover. Turn the terrarium over and punch several small holes in the bottom for drainage.

4. Put a 1" layer of gravel in the terrarium, making sure the drainage holes are covered but not plugged.

5. Assess the needs of the animal guest before adding soil or sand, dried leaves, grass seed, twigs, or small rocks to make the terrarium similar to its home in the wild. Also consider the animal's need for light, moisture and temperature when choosing a place for the terrarium in the classroom.





Science Focused

Jack, The Seal And The Sea

(GPN # 67)

Author: Gerald Aschenbrenner
Publisher: Silver Burdett Press

Program Description: On a Discovery Voyage — a floating laboratory in the San Francisco Bay — LeVar identifies a variety of marine life and learns about protecting the oceans. Video footage of an oil spill clean-up effort in Alaska shows how difficult it is to restore the environment once it's been polluted.

The Moist Wonderful Bulletin Board

Key Words: *water use, conservation*

Concept: *Knowing that activities use different amounts of water can help us consider ways to conserve water.*

Stimulate a discussion about water use and conservation.

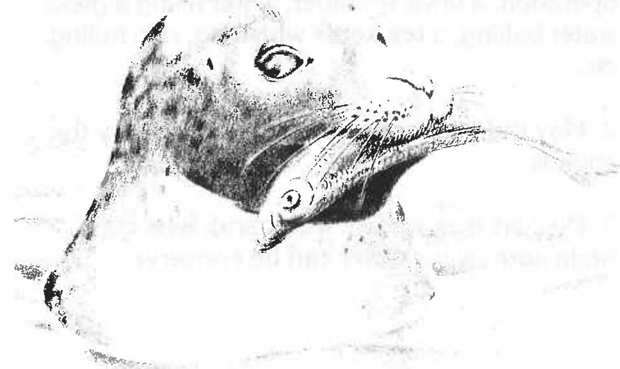
Materials: Paper, crayons; optional: watercolor paint, water, rectangular pan.

1. Cut large raindrop shapes from paper, then ask students to draw and color one of the ways they use water on these drop shapes.

2. In small groups, have them tell about their pictures and then, as a group, arrange the pictures from the activity that uses the least water to the one that uses the most.

3. As a class, create a bulletin board with "drops" representing the most water-use on one side and the least on the other.

Extension: Add another dimension by using a watercolor bath to create "paint resist" art. Dip the crayon-colored drop-shaped drawings into a pan of water soluble paint (one cup of water tinted with watercolor paint). The paint will soak into the non-crayon coated sections of the paper. Allow these to dry overnight before hanging them on the bulletin board.



No Sweat

Key Words: *water, condensation, heat*

Concept: *Condensation can occur on cool objects.*

Cool air holds less water vapor than warm air. As a result, when air cools, water vapor becomes tiny droplets of condensed water that stick to surfaces. This can be observed with a glass of ice water — when the air around the glass cools, water vapor condenses and drops of water accumulate on the glass making it wet.

Materials: Water, ice, container (can, glass or jar), paper, pencils, table knife (optional).

1. To show condensation, place ice water in a container and let students observe the droplets forming on the outside. Discuss why the droplets occur and how they form.

2. Have students illustrate this concept by making a drawing. (If there are students who mistakenly think the water seeps through the container rather than condensing from the air, place a shiny solid object such as a table knife in the ice water. After the knife has been chilled, remove it from the water, wipe it dry and have the class watch as water condenses on it.)

It's Wet, Hear

Key Words: *sound, water, conservation*

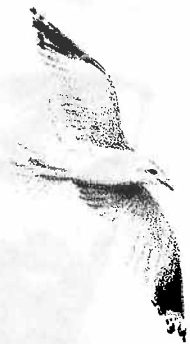
Concept: *We use water in many different ways.*

Materials: Tape recorder, tape of water sounds.

1. Make a tape recording of water being used — water running in the sink, a toilet flushing, water dripping, ice tinkling in a glass, a shower running, someone washing dishes, a washing machine in operation, a lawn sprinkler, water filling a glass, water boiling, a tea kettle whistling, rain falling, etc.

2. Play the tape and have students identify the sounds.

3. Discuss how we use water and, as a class, brainstorm ways water can be conserved.



Now It's Salty, Now It's Not

Key Words: *water vapor, condense, temperature, freezing, humidity*

Concept: *Water evaporates from oceans but salt does not.*

Rain forms when water vapor in the air condenses. Most of this water vapor has evaporated from the oceans. Since oceans are made up of salt water, it seems likely that rainwater would be salty, but it isn't because as ocean water evaporates, the salt is left behind.

Materials: Water, salt, paper cups, zip-locking plastic bags.

1. Give groups of students a paper cup of salt water. Have each of them taste the water and confirm that it is salty by dipping the tips of their fingers in the water and putting it on their tongues.

2. Have each group place their cup of salt water in a zip-locking plastic bag (which has been labelled with the group's name or number) and zip it shut. Place the bags in a warm place, such as a sunny window, where the water will evaporate from the cup. *(As the water evaporates it will collect in the plastic bag; however, the salt does not evaporate and will remain in the cup.)*

3. When several teaspoons of water evaporate from the cup and condense inside the bag, have students carefully open the bag and pour the water into a tasting cup. Any remaining water in the evaporation bag cup will be salty, but the water retrieved from the plastic bag will not.

Free Frost

Key Words: *frost, condense, temperature, freezing, humidity*

Concept: *Frost forms when water condenses at temperatures below freezing.*

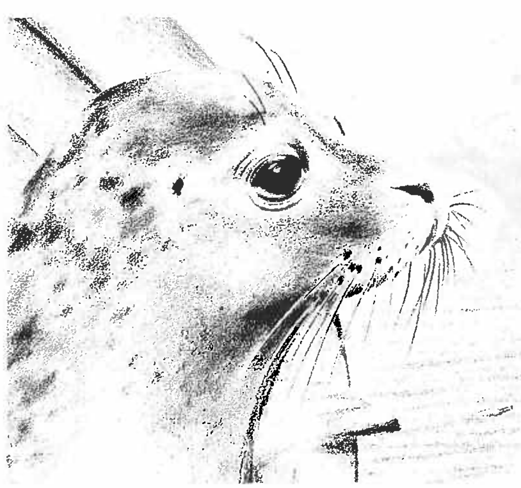
Frost forms when water condenses at temperatures below freezing. At night, objects lose heat to the air. If an object cools to below freezing and there is a sufficient amount of water vapor in the air, frost will form on it. Because clouds help hold heat in the air, frost (and dew) form more easily on clear nights than on cloudy nights. It's possible to make frost if there is enough humidity in the air.

Materials: Ice, salt, can, steaming water (optional).

1. Place several cups of crushed ice in a can.

2. For each cup of ice, stir in one tablespoon of salt. The ice and salt will make the temperature on the outside of the can fall to below freezing and, if there is enough humidity in the air, frost will form on the outside of the can. (If there isn't enough humidity in the air, hold the can over a pan of steaming water.)

3. Discuss when students have seen frost (e.g., outside on cold mornings, in the freezer) and what conditions have caused it.



Up, Down, and All Around

Key Words: *water vapor, air, condense, droplet, precipitation, evaporate, water cycle*

Concept: *The steps of the water cycle — condensation, precipitation, evaporation — occur repeatedly and in many places in the environment.*

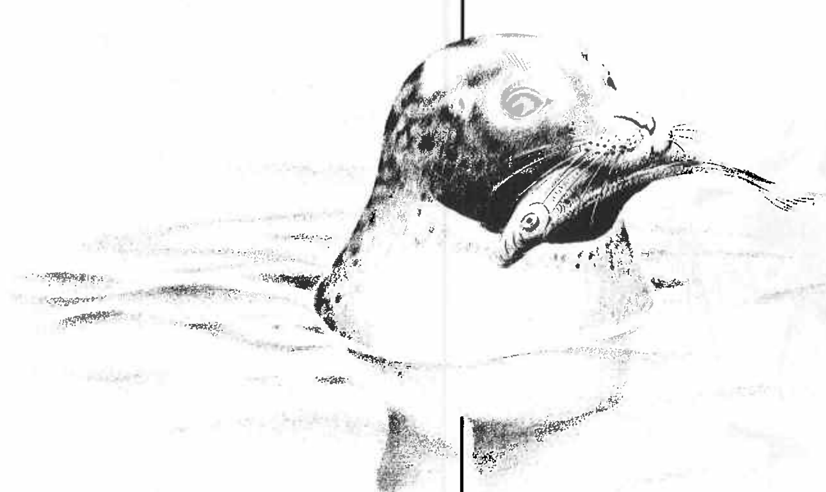
Water is contained in the air as water vapor. When air cools, the water vapor often condenses to form droplets that make up dew, fog and clouds. If the air cools — and the droplets grow large enough — it rains. If the air is cold, precipitation will take the form of hail or snow. This precipitation forms water vapor again as it evaporates from the ground. These steps — evaporation, condensation, and precipitation — happen continually and are known as the water cycle.

Materials: Water, paper towels, cardboard, pie pan or flat dish.

1. To show evaporation, have students wipe water on the back of their hands with a wet paper towel and then fan their wet hand with a piece of stiff cardboard. Ask them to explain what happened to the water.

2. To observe the results of evaporation, have groups of students put a small amount of water in a pan or dish and leave these overnight. Conditions that will speed evaporation are warmth, air circulation and a large surface area of water. Relate these results to step one.

Evaporation also occurs when clothes dry or puddles disappear after a rain. In each case, small water particles (molecules) mix with the air and become water vapor.



June 29, 1999

(GPN #100)

Author: David Wiesner
Publisher: Clarion

Science Connected

Program Description: LeVar explores far-fetched fact and fiction when he investigates a UFO (Unidentified Flying Objects) sighting, hears a first hand UFO account, finds out about a boy and his father who've discovered strange artifacts, and meets a farmer who grows huge pumpkins.

Home Sweet Home

Key Words: light, plants, thermometers, temperature

Concept: A greenhouse can protect plants from cool weather.

In the book **June 29, 1999**, there is broccoli the size of a tree and peas as large as boats. These vegetables may be fictional, but the 200-pound pumpkins grown by Howard Gill in Nova Scotia are not. To grow those giant pumpkins, Mr. Gill combines his knowledge about how plants grow with lots of hard work. Although you can't grow pumpkins as large as a tree or a boat, there are some proven methods to increase the size of vegetables—and using a greenhouse is one of them.

Materials: 2-liter soda bottle made of clear plastic, scissors, two small child-safe thermometers with plastic backs, a sunny day.

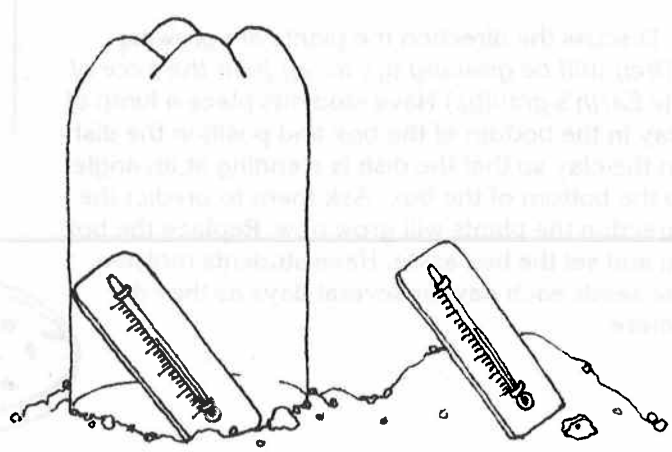
1. Discuss how pumpkin grower Howard Gill placed green houses over his young pumpkin plants to protect them from cool weather, and that the term hot house is sometimes used for a greenhouse. To explore this further, create a small greenhouse by cutting the top off of a clear plastic 2-liter soda bottle using a pair of large scissors.

2. On a bright sunny day, have students put the top of the bottle upright in loose soil or sand with a thermometer inside of it. Arrange the bottle so that the thermometer is facing away from the sun. Place a second thermometer outside the bottle in a position similar to that of the first thermometer. Ask them to predict what will happen to the temperature readings on each thermometer.

3. Have students read and record the temperature on each thermometer immediately and then again after about 10 minutes. They will note that the temperature on the thermometer in the bottle is higher than the temperature on the one outside the bottle.

Discuss why they think that difference occurs. Explain that sunlight contains high-energy waves—ultra violet radiation—which can move through the plastic; however, after the waves are absorbed by the soil they are re-emitted as lower energy heat waves—infra-red radiation. The lower energy heat waves cannot get back out through the plastic, so they collect in the bottle making the temperature warmer.

4. Ask students in what other ways, besides providing warmer temperatures, might a greenhouse help young plants grow. (*It not only protects young plants from cool weather, it also protects them from wind, some insects, and helps keep plants from drying out by trapping moisture inside the greenhouse.*)



Which Way Is Up?

Key Words: *Plants, gravity*

Concept: *Plants react to gravity.*

Holly, a student in this episode's feature book, isn't the only one interested in sending plants into outer space. Some of the scientists at the National Aeronautics and Space Administration (NASA) conducted plant experiments on the space shuttle. They were interested in how plants would react to an environment where the force of gravity is not felt. Although we can't see how plants grow without gravity, we can experiment with plants and gravitational force.

Materials: A fast growing grass seed such as annual rye, petri dishes or small lids, rubber bands, nylon scouring pads, spray bottle filled with water, cardboard boxes with lids such as large shoe boxes, modeling clay.

1. Cut the nylon pad into a circular shape so it fits snugly into the petri dish (or into a lid). Put the pad into the dish and check the fit by turning the dish over to make sure that the pad will not fall out. If it does fall out, stretch a rubber band over the middle of the dish to hold the pad in place.

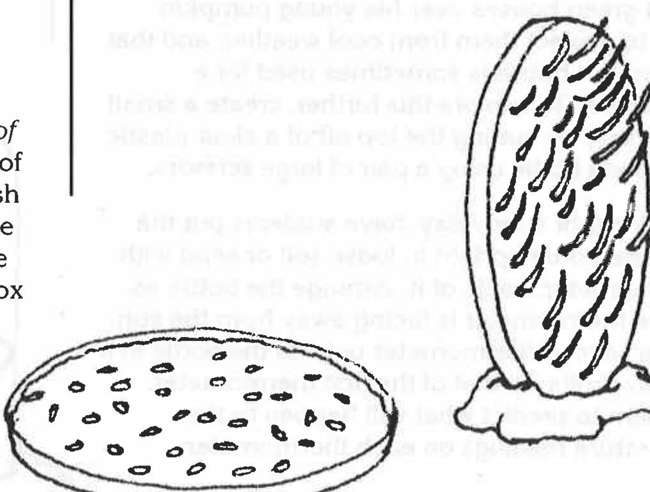
2. Set the dish down in the bottom of a box with the pad side up. Sprinkle grass seed onto the pad, then spray the seeds and pad with water.

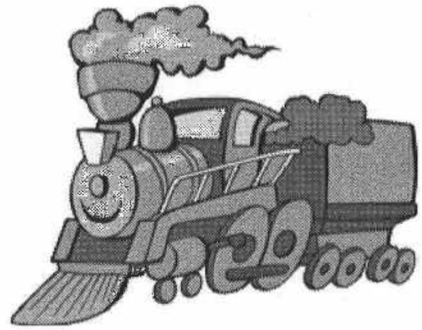
3. Cover the box with the lid and set it aside. Have students open the box and moisten the pad each day for several days until the seeds have sprouted and the young plants are about 1/2" tall. Because the seeds need oxygen to sprout, have students drain off any excess water so the pad and seeds are damp but not flooded.

4. Discuss the direction the plants are growing. (*They will be growing up, away from the force of the Earth's gravity.*) Have students place a lump of clay in the bottom of the box and position the dish on the clay so that the dish is standing at an angle to the bottom of the box. Ask them to predict the direction the plants will grow now. Replace the box lid and set the box aside. Have students moisten the seeds each day for several days as they did before.

5. After several days, re-examine the young plants. Which direction are they growing now? (*The plants will turn so that they continue to grow away from the pull of gravity.*) Ask students to predict which way seeds might grow in space? (*When the NASA scientists tried sprouting seeds in space, the seeds grew in all different directions. Since there was no force due to gravity present, the seeds did not respond the way they do on earth.*)

6. Students may wish to reposition the dish one more time to see if the young plants turn again. (*As the plants grow larger the effect of growing away from gravity—called gravitropism—will become harder to see.*)





Kate Shelley And The Midnight Express

(GPN # 79)

Science Connected

Author: Margaret K. Wetterer
Illustrator: Karen Ritz
Publisher: Carolrhoda

Program Description: **LeVar visits the Amtrak yard to see how trains are maintained before he boards the Coast Starlight for a train ride along the California coast. He meets the engineer as she's driving the train and finds out what engineers do. Film clips of early trains show how things have changed.**

Rolling Down The Railroad

Key Words: *momentum, mass, speed, trains*

Concept: *Trains take a long time to stop because of their great mass and speed.*

Anyone who works around trains will caution children never to play near railroad tracks because trains take a very long time to stop. Trains have a great deal of momentum. Momentum is the scientific measure of an object's mass and speed. The more momentum something has, the longer it takes it to slow down and stop. Because trains generally travel at high speeds and are so large and heavy, their momentum is great. It takes a very, very long time for a train to stop.

Materials: A child's roller skate with wheels that turn easily, two similar large soup cans—one empty & one full and unopened, several books, a piece of plywood or other thin wood that is about 24" x 6", a hallway or other open area with a hard smooth floor-covering, large rubber bands, masking tape, meter stick (optional).

1. On a smooth hard surface floor have students create a ramp by slanting a piece of wood from the top of a 4" or 5" stack of books.

2. Have them fasten an empty soup can to a roller skate using rubber bands or masking tape. Then have them release the skate from the top of the ramp and observe as it rolls down the ramp and across the floor until it comes to a stop on its own. Use masking tape to mark the point where the can stopped and/or measure the distance using a meter stick.

3. For the next trial, have students fasten a full, unopened soup can on the skate. Before they release the skate have them predict whether they think it will go a longer or shorter distance than the skate with the empty can. Have them release the skate and mark or measure the point where it stops. Ask them why this skate went further. (*This skate carries a heavier load/mass and its momentum is greater so it will travel a longer distance. Because of the mass it carries, a train will take a very long time to stop, even with strong brakes.)*

Extension: Measure how far the skate travels with other objects attached to it.

Letting Off Steam

Key Words: *Steam, forces, push, pull*

Concept: *Steam can be used as a force to push objects.*

Most modern trains use diesel or electrical power, but the very first trains used steam to power their mighty engines. They burned wood or coal to heat water that produced steam. The steam then pushed the pistons that drove the engine.

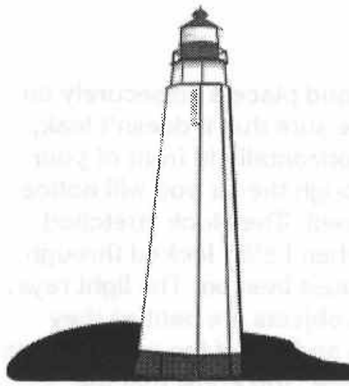
Materials: Tea kettle with a whistle, hot plate, water, meter stick, 2" x 6" strip of waxed paper, tape, a cooking mitt.

1. Have students tape a strip of waxed paper to the end of a meter stick.

2. Place several cups of water in a cool teakettle, set it on a hot plate and turn on the heat. Explain that as the water heats up, it will change to water vapor and steam, which will rise from the kettle. Remind students to stay back from the hot plate, the kettle, and the steam because all will be very hot and could cause burns.

3. After the whistle on the kettle indicates that the water is heated, turn off the hot plate, put on a cooking mitt and remove the kettle. Ask students to share their thoughts on what caused the whistle to sound. (*The rising steam was forced out of the kettle whistle causing it to sound in much the same way as when they blow in a whistle.*)

4. Turn the hot plate back on. Before putting the kettle on the hot plate, latch open the kettle spout lid (remember to wear a cooking mitt for this). To show how steam can be used to push objects, ask a student to hold one end of the meter stick and position the end with the waxed paper strips over the steam escaping from the kettle. Ask students to describe what happens to the paper strip. (*The force that is created by the hot water changing to steam is pushing them. This is the same force that moved steam engines.*)



Keep The Lights Burning, Abbie

(GPN #37)

Author: Peter and Connie Roop
Illustrator: Peter E. Hanson
Publisher: Carolrhoda

Science Connected

Program Description: LeVar travels to the rocky shores of mid-coast Maine to tour a modern day lighthouse, joins a sailing family for a day at sea on their 100-foot coasting schooner, and learns about the mystery of putting a ship in a bottle.

Spoon Light

Key Words: *light, concave mirrors, reflection*

Concept: *A concave (bowl-shaped) mirror can be used to enlarge and redirect light.*

In the story **Keep the Lights Burning, Abbie**, the lighthouse beacon was made by lanterns placed in a horizontal circle. Each lantern had a shiny bowl-shaped mirror behind it. These special mirrors were used to enlarge the light from each lantern and reflect it out to sea.

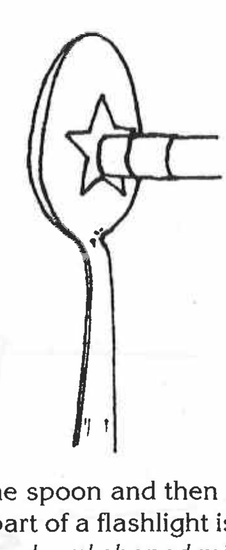
Materials: Large spoon that is round and shiny, new pencil, glow-in-the-dark paper such as glow-in-the-dark stars or any brightly colored paper, tape, flashlight.

1. Hold up a large, round spoon (the rounder, the better) so that the back of the spoon is facing you. Point into the middle of the spoon using your index finger. Hold your finger so that it is almost touching the spoon. Closely observe the reflection of your finger on the back of the spoon. Then turn the spoon over so that the front of the spoon is facing you. Again point into the middle of the spoon with your index finger. How is the reflection of your finger different? (*The reflection of your finger will be much larger and will almost cover the inside of the spoon.*)

The spoon is similar in shape to the shiny mirrors used behind the lanterns that Abbie had to light. Just as with the spoon and the refection of your finger, the mirrors behind the lanterns reflected and enlarged the light coming from the lanterns.

2. Because it could hurt your eyes if you were to shine an bright light into the spoon, make a model of a light by taping a glow-in-the-dark star or a brightly colored paper dot to the eraser end of a new pencil.

3. Hold up the spoon so that the front of the spoon is facing you. Then move the star end of the pencil toward the center of the spoon. Watch for the point where the image of the star becomes very large. You may not be able to see the star shape but the color of the star will fill the inside of the spoon. If you are using glow-in-the-dark paper, try the same thing in a dark area after exposing the star to light. The glow of the star will light up the inside of the spoon.



4. Think about the spoon and then look at a flashlight. What part of a flashlight is like the spoon? (*The shiny bowl shaped mirror behind the bulb.*) Why is there a shiny bowl-shaped mirror behind the bulb? (*It will enlarge the light from the bulb and reflect it forward.*)

Bent Beam

Key words: *light rays*

Concept: *A beam of light can be bent.*

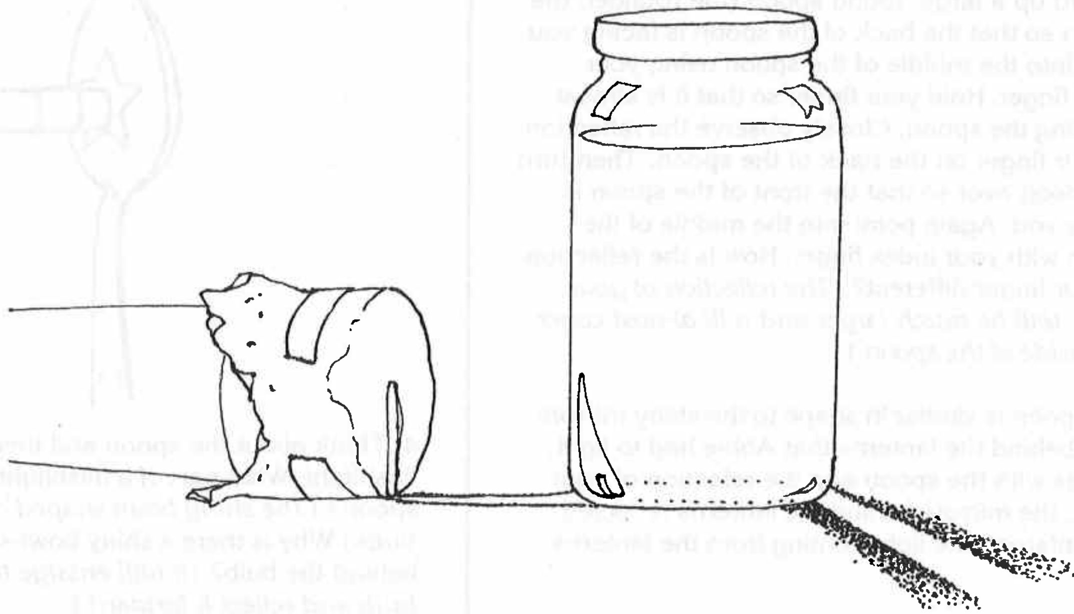
The lighthouse that LeVar visited had a beacon with a 1000 watt light bulb that was surrounded on the top and bottom by glass prisms. The lighthouse keeper explained that the prisms bent the light rays from the bulb that would shine down to the floor and up to the ceiling back to the middle of the beacon and out to sea. Light rays usually travel in a straight line, but light rays will bend (i.e. change direction) as they pass from one substance into a different substance. Light rays passing from air into glass will bend as they did in the lighthouse beacon. Light rays will also bend as they pass from air into water.

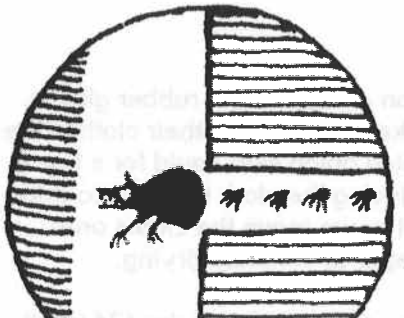
Materials: Round, clear glass or plastic jar with a lid, water, pencil, flashlight, foil, knife or scissors.

1. Fill a round, clear-glass or plastic jar with water. Place a pencil in the jar and look at it from the side of the jar. The pencil will appear to be bent at the point where the pencil enters the water. This is because the light reflecting from the part of the pencil in the water is bent slight by water. Slowly move the pencil up and down. Notice that the bend in the pencil also moves. Whatever part of the pencil is just below the waterline is where the bend will appear.

2. Remove the pencil and place a lid securely on the jar. Tilt the jar to be sure that it doesn't leak, then hold the jar up horizontally in front of your eyes. As you look through the jar you will notice that objects look different. They look stretched out, just as they did when LeVar looked through the glass in the lighthouse beacon. The light rays being reflected off the objects are bent as they pass from the air, into and out of the water, before finally reaching your eye. You know that the objects have not changed. Only the light rays have been changed.

3. Cover the front of a flashlight with foil. Then use a knife to cut a thin slit in the foil from the center down, so that only a narrow beam of light shines through. Place the flashlight on a table or other flat surface so that the slit in the foil is at the bottom. Place the round jar filled with water in front of the light so that the beam of light shines through the jar. Move the jar back and forth in front of the light. What happens to the beam of light? (*It is bent.*) Why is the light bent? (*The beam of light is bent as it passes from the air into the water and back into the air. Light is bent whenever it passes through different substances.*)





The Legend Of The Indian Paintbrush

(GPN # 73)

Author: Tomie dePaola
Publisher: Putnam

Program Description: LeVar visits the Pueblo Indian people of Taos, New Mexico where Mother Earth plays a crucial role in their art. He interviews a painter, a family of pottery makers, and a family of dancers—and they explain the traditions behind their art and their Native American culture.

Dust In The Wind

Key Words: *light, color, atmosphere, sunset, reflection*

Concept: *Particles in the air affect light, causing the colors we sometimes see at sunset.*

The beautiful red and orange colors Little Gopher saw at sunset were created by sunlight passing through the atmosphere around the earth. The atmosphere is full of dust and other tiny particles that reflect and scatter light. At sunrise and sunset, when the sun appears low in the sky, the light from the sun has to pass through more atmosphere which means that there is more dust to affect it. When this happens the blue rays in sunlight are scattered and reflected away from us. We then see more of the remaining red and orange rays in the sunlight. Because the presence of dust and other particles in the air is important, some of the most beautiful sunsets are seen over the desert or prairie after a dry, dusty day.

Materials: Clear jar of water, 1/4 cup of milk, flashlight, spoon.

1. Hold a flashlight so that it is shining straight down through a jar of water. Then look horizontally into the water at eye level. Does it have any color? If the water is clear, the light will pass down through it and it will not appear to have any color because light rays are not being reflected or scattered out through the sides to your eye. In this activity the water in the glass will represent the atmosphere surrounding the earth.

2. Now add some "dust" particles to the atmosphere. Stir a spoonful of milk into the water. Again hold the flashlight so that it is shining down through the water. Look at the water from eye level and continue to add milk, a spoonful at a time. Soon you will see some color appear in the milky water as some of the light is reflected or scattered out of the glass by the milk particles. At first you will see a light blue color. Then as you add more milk, or more particles to your atmosphere, the color will change to pinkish. The differing amounts of particles in the water changes the colors of light that are scattered out of the glass and to your eye.

Natural Beauty

Key Words: *colors, dyes*

Concept: *Plants can be used to color cloth.*

Native American artist Dominic Arguero painted a colorful sunset using paints that he made from natural materials. Use natural dyes to make a sunset-colored handkerchief.

Materials: Squares of white cloth cut from an old cotton sheet (do not use cloth that has been washed with a fabric softener), water, pans with lids, heat source, colander, string, beets, yellow onion skins, apron or old shirt, rubber gloves, sink, sheets of newspaper.

1. Place some beets in a pan and some onion skins in another pan. Cover each with about 2 cups of water and bring to a boil. Cover and simmer for about 15 minutes. (If fresh beets are not available, you can use the juice from canned beets.)

2. After the mixtures have cooled, remove the plants by pouring each mixture through a colander. Place the remaining colored liquids back in the pans. Cover the area around the pans with newspaper.

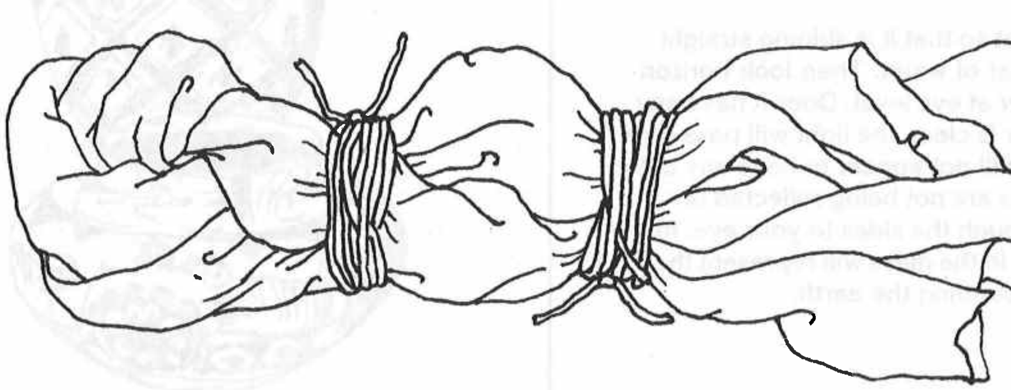
3. Have each student bunch up a piece of cloth making a long thick shape, then wrap a long piece of string (2 or 3 feet long) **very tightly** around one end of their cloth (see illustration). Students who wish to can tie a second piece of string tightly around another part of their cloth.

4. After putting on an apron and rubber gloves, have students take turns placing their cloth in the pan with the cooled onion skin liquid for a few minutes. Then placing the cloth in a sink to drip dry. After several hours move the cloths onto sheets of newspaper to continue drying.

5. After the pieces are completely dry (24 to 48 hours), have students tie one or two additional strings tightly around other parts of their cloth. This time, using the beet liquid, repeat the procedure in Step 4.

6. When the cloth is completely dry again, cut the strings, remove them, and unfold the cloth. The areas covered by the strings will not have been completely dyed, making white, yellow, and red patterns on the pieces of cloth.

Science Note: As the cloth was dyed, particles of the dye became attached to particles of the cotton. When light rays hit areas of the cloth where particles of the onion skin dye are attached, yellow light rays are reflected back to our eyes. (The other colors are absorbed into the cloth.) When light rays hit areas of the cloth where particles of the beet juice dye are attached, red/violet rays are reflected back. The colors made from natural dyes are not very bright. Other plants that can be used for dying are: cherries, red cabbage, spinach, and tea.



The Life Cycle Of The Honeybee

(GPN # 36)

Author: Paula Z. Hogan
Illustrator: Geri K. Strigenz
Publisher: Raintree/Steck-Vaughn

Science Focused

Program Description: Where does honey come from and how is it made? LeVar's curiosity is satisfied when he visits a real-life beekeeper, examines a beehive and learns how important the queen bee is to the well-organized hive.

A Way To Beegin

Key Words: *color, choice, graph, bar graph, pictograph, ultraviolet*

Concept: *Bees use flower colors, including some we cannot see, to find food.*

Make large flowers from colored paper, using shades bees can see (violet, blue, blue-green, yellow, purple—don't use red or green). Post them on the bulletin board. Have students write their names on an accurate outline of a worker bee and then ask them to place this bee on their favorite colored flower. Discuss and summarize the results with the group.

- Which color was chosen most often?
- Which color was chosen least often?
- Were any colors chosen by the same number of students?
- How many more chose (one color) over (another)?
- Would the results be the same with a different group?
- Would the results change if this was done again in the same class?

Discuss the fact that the job of worker honeybees is to gather nectar from flowers and return to the hive.

Extension: Summarize the results in a bar graph, pie graph or pictograph and/or by sequencing the colors according to the frequency they were chosen. Students can also create a bar graph by making a small uniform-sized flower of their favorite color, and placing these end to end with other flowers of the same color. Each flower represents a vote for that color.

Science Note: Bees do not see the colors red and green (which look grey to them); however, they see other colors in the ultra-violet range that we cannot see. This means that flowers look different to bees. In fact the ultraviolet colors often create patterns that accent the center where the nectar can be found—just what bees are looking for.

Bee Fore And Bee After

Key Words: *drawings, comparing, detail*

Concept: *By studying animals, such as bees, we can learn details of what they look like.*

Materials: Drawing paper, pencils.

Before beginning the study of bees, have the students draw a bee with as much detail as they can. Save these drawings and at the end of the study, have them draw the bee again and compare their two drawings. Can the students see anything they were able to add as a result of studying bees? Discuss what they have learned about bees.

Bee Body Language

Key Words: *specialization, communication, pattern*

Concept: *Bees can communicate using patterns of movement.*

Bees in a hive have many jobs to do, so the work is divided into several categories, with bees specializing in one particular job. One of these jobs is finding food. When one of these bees finds food, it communicates the location to other food-finding bees. Since bees can't write or talk as we do, they communicate with an intricate pattern of body movements.

Materials: Items to hide.

1. Each group of 3-4 students has an object which represents their food source.

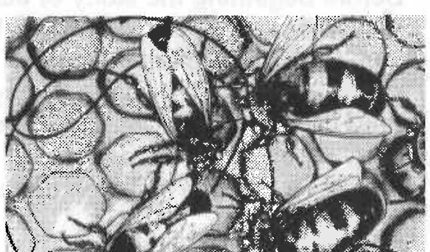
2. A group member hides the "food" in the hall or outdoors, and returns to the group. Without speaking or writing the student attempts to communicate where the "food" is located using body language. Group members try to find it.

3. The team can repeat this several times.

4. Apiarists (beekeepers) have found that bees have a fairly standard language of body movements. After the first 2 or 3 tries, have the groups develop an unspoken, unwritten language to use.

Science Note: Karl von Hirsch was the scientist who researched and described bee body language—also known as bee dances. As a bee buzzes about, it finds a source of food—usually a flower. This bee then tells other bees of its discovery.

Back at the hive, the bee communicates information about the new food source using movements that look much like a dance. During this dance, the first bee shares the scent of the food with other bees to help them identify the flowers. With specific motions, the bee indicates the direction and distance to the food. The other bees can then fly straight (or make a beeline) to the new source of food.



Smell Can Tell As Well

Key Words: *communicate, smell, antennae, odor*

Concept: *Bees can communicate using odors sensed by antennae.*

In addition to movements, bees also communicate using scent which they "smell" with their antennae. They remember the specific odor and use this as a cue to tell other bees what kind of flowers have been found. A bee tends to collect all the nectar from one type of flower before moving on to another type of flower.

Materials: Dry household scents that are safe to smell, e.g. cloves, fennel seed, cinnamon stick (not ground cinnamon which can be irritating), dark paper pieces 3"x5" (7.5cm x 12.5cm), stapler, cotton and/or cheese cloth, yarn.

1. Fold the paper in half and punch 2-3 holes in one side.

2. Wrap each one of the dry, scented substances in cotton or cheese cloth (to hold it together), then place it in the paper and staple it around the edges. (Make several sets of scents so each group of students has a set.)

3. Have students try to identify the scents from memory. Then pass out one labeled scent packet at a time and have them label their packets by matching the scents.

Extension: Provide pieces of cotton cloth, yarn and scented items so students can make sachet packets to take home.

Alternative: Odor matching can also be done using the flowers from ***A Way To Beegin*** by scenting the paper flowers with vanilla extract, almond extract and other pleasant smells. Ask the children to place their bee on their favorite scented flower. Then discuss how bees use odor, as well as color, to find nectar. Have students take the decision-making a step further by comparing their favorite color and favorite smell—if they aren't matched on the same flower, which would they choose and why?

A Wonderful Place To Bee

***Key Words:** hexagon, bee hive, efficient, bees wax, honey comb*

***Concept:** The hexagons bees make in a bee hive are efficient spaces.*

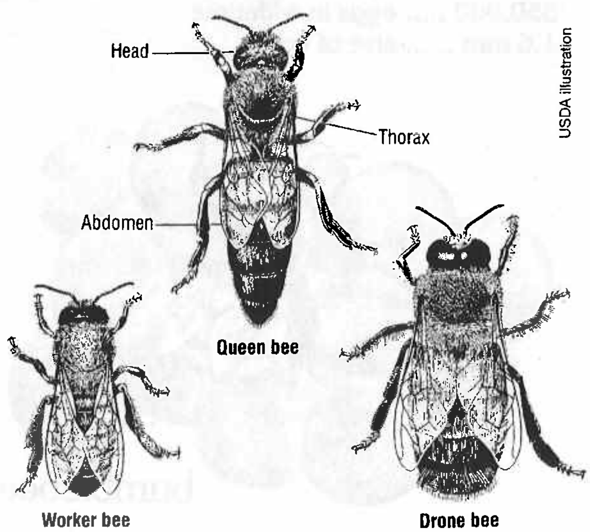
The hexagon shapes created by bees for their hive are very efficient storage shapes. Circles are efficient spaces for bee-shaped bodies, but do not fit together well and would waste wax; squares fit together well, but the inside space is not efficient. Explore the relationship of shapes.

Materials: Paper, pencil, small round objects to trace (e.g. coin, bottletop, round counters).

1. Have students draw a circle (by tracing a round shape) and mark it with an "x" in the center. This will be the center circle. Then ask them to predict how many circles of the same size will fit around this one (the answer is six). Have them test their prediction by drawing circles around this center circle.

2. Now have them predict how many circles it would take if they used a larger or smaller circle. Have them test these predictions (six still fit).

3. Next have them choose one circle size and continue to draw circles to get a pattern like a honeycomb. After they have several hexagonal clusters, an even more convincing hexagon shape can be created by putting a dot in the center of the triangle-shaped spaces between the circles and connecting these dots with lines drawn between (not through) the circles (see illustration).



USDA illustration

Bee Wise

***Key Words:** fact, research*

***Concept:** Through research in books, new facts can be learned.*

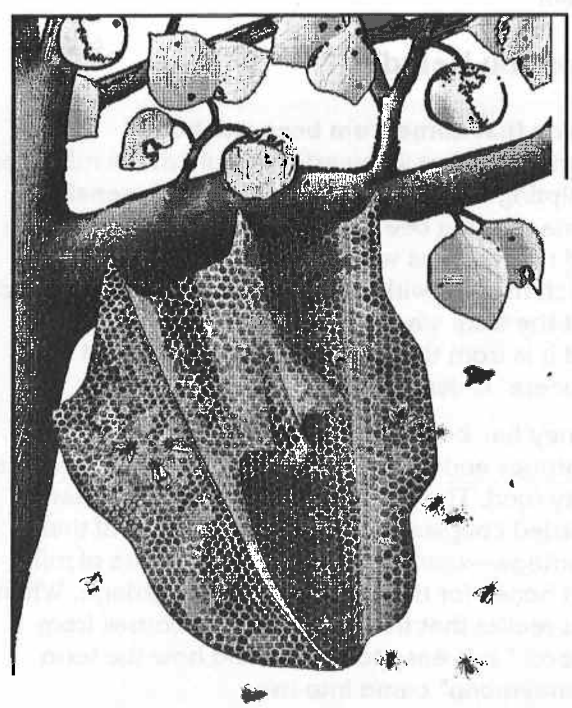
The class can create a "honeycomb" of bee facts at an activity center. Set out several books about bees, and provide paper pieces cut into the hexagonal shape of a honeycomb cell. Students can visit the center and read about bees. When they find a new bee fact, they can write it on a piece of the hexagonal paper and add it to a growing honeycomb bulletin board.

A Bee To See

***Key Words:** head, thorax, abdomen, queen bee, drone bee, worker bee*

***Concept:** Bees are the same in some ways and different in others.*

Honeybees are unique insects. Although there are 5000 species of bees, there is only one bee that specializes in the production of honey—the honeybee (*Apis mellifera*). Of the three types of honeybees—the queen, drones and workers—only the workers collect the nectar for making honey.



Bee Dough (Non-cooked Snacks)

Key Words: head, thorax, abdomen, wings

Concept: Bees have certain body parts, including a head, thorax, and abdomen.

Students can use what they have learned about bee bodies to shape these treats into realistic bee models. These are real honeybees as you can see from the recipe:

1 cup peanut butter	1 cup powdered milk
1/2 cup honey	sliced almonds

- Mix the first three ingredients, adding powdered milk and honey to taste, to make a dough that is the consistency of regular cookie dough (the exact amount of honey and powdered milk will depend on the temperature and the amount of oil in the peanut butter).
- Have students wash their hands, then give each student about a tablespoon of dough to shape into the form of a honeybee. Emphasize that the bee should have a head, thorax and abdomen, and two pairs of wings (the sliced almonds) attached to the thorax. They may have other suggestions to make the honeybees more realistic.
- Compare the dough bee models to an illustration of a bee. By then it may BEE time to eat!

Alternative: Bees can also be created out of clay; the finished products can be displayed rather than eaten!

Hive You Heard?

Words that come from bees and honey
In ancient times when artists would make mistakes sculpting stone for statues, they would repair the damage using bee's wax. Those sculptures which had no mistakes would be signed "sine cere" which means "without wax." "Sine cere" indicated that the work was truly all that it appeared to be and it is from this expression that our word "sincere" is derived.

Honey has been known as a delicious food for centuries and many customs centered around this tasty food. The Vikings had a custom that newly married couples—to insure the success of their marriage—would drink a special mixture of milk and honey for their first month of marriage. When you realize that the word "month" comes from "moon," it is easy to understand how the term "honeymoon" came into use.

Bee Facts

Bees in a Hive
60,000..........workers
100..............drones
1..................queen

The Honeycomb
6.................sides to a cell
5.................cells per inch

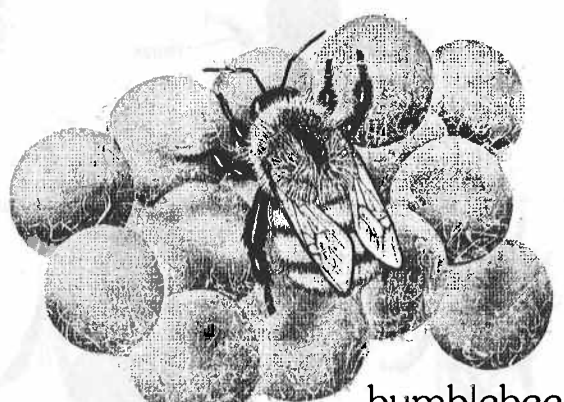
For a Pound of Honey
40,000 .... trips
50,000 .... flight miles
2,000,000 .. flowers

Bees as Babies
3 .... days as an egg
6 .... days as a larva
12 .... days as a pupa
100,000 ..... feedings while a larva

Bees as Adults
21 .... days in hive work stage;
3 .... days cleaning cells
3 .... days feeding older larva
7 .... days feeding young larva or queen
5 .... days building combs, storing nectar
3 .... days guarding, cleaning, ventilating the hive
21 .... days in field work stage: collecting nectar, water & pollen.

Adult Workers
1.2 cm .... long
10 .... miles per hour in flight

The Queen Bee
1,500 .... eggs
350,000 ..... eggs in a lifetime
1.6 mm ...... size of egg



bumblebee